Measuring Intelligence of Indian Children

By the same Author

HINDI HUDUGARA BUDDHIMÂPANAVU (Kannada)

HINDI MULÂNCHEN BUDDHIMÂPAN (Marathi)

These are the actual tests administered to the children in their mother-tongue

V. V. KAMAT, PH.D.

Measuring Intelligence of Indian Children

With a Foreword by

JOHN McKENZIE, M.A., D.D.

Lately Principal, Wilson College, Bombay

THIRD EDITION

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Dedicated to the memory of

MY PARENTS,

who lived a life of purity,

simplicity and truthfulness

FOREWORD

MR Kamat has devoted much time for several years past to the study of intelligence testing, and he has been one of the first Indians to devise tests to be used through the medium of Indian languages. This book is the fruit of his study and practical work. He has gone on the justifiable assumption that there is nothing in the mental constitution of Indian children that warrants the psychologist in trying to devise tests radically different from those which have been found suitable in the West. He has, accordingly, given some account of the history of intelligence testing, and has shown the purposes it has been designed to serve; and he has taken one of the best known and most successful systems—the Binet-Simon, with the Stanford revision—and has adapted it for use in India through the Kanarese and Marathi languages. He has given us not a work of pure theory, elaborated in his study, but a work which reveals at almost every point traces of his own practical experience. I am convinced that there is a large place for intelligence testing in Indian education, and I believe and hope that Mr Kamat's work will prove to be influential in giving both stimulus and guidance to other educationists in all the provinces of India in the use of tests.

JOHN MCKENZIE

Wilson College, Bombay

PREFACE TO THE THIRD EDITION

IN this edition an appendix on the 'Gujarati Standardization of the Bombay-Karnatak Revision of the Binet-Simon Scale' has been added, as it was thought necessary to give readers an idea of the work done in this field up to the present time. The Bibliography has been brought up to date by the addition of the most important accounts of recent work done on intelligence testing, particularly in India.

Indian Institute of Education,
Bombay

V. V. K.

PREFACE TO THE SECOND EDITION

ONLY a few minor changes are made in this edition and the discussion on the nature of intelligence has been brought up to date. Two new appendices on 'Sex Differences among Indian Children in the Binet-Simon Tests' and on 'Heredity and Environment', which were originally published in *The British Journal of Educational Psychology*, Birmingham, and in *Teaching*, Vol. XIII, No. 2, Bombay, respectively, based on the data with which this book is concerned, have been printed at the end of the book, with kind permission of the publishers.

Indian Institute of Education,
Bombay

V. V. K.

PREFACE TO THE FIRST EDITION

THIS study of the intelligence of Indian children was begun a few years ago, when experiments in the field of education or psychology were practically unknown in India. When the writer talked about his work to several of his friends and fellow educationists, almost all of them threw cold water on his enthusiasm and laughed at his going from place to place

with a bag of test material in hand. The author finds pleasure in recording that in these early days it was Mr W. Grieve who, narrating his own experience on the subject, spoke very encouragingly about the experiment and its utility in education. At the same time he rightly put the author on his guard against difficulties that were to be encountered. The author's very best thanks are, therefore, due to him, as also to Mr K. S. Vakil who always had a word of appreciation for the work and who gave the author the free use of his excellent private educational library. The greatest encouragement and inspiration came from Professor Godfrey H. Thomson, Head of the Department of Education, University of Edinburgh, under whose guidance the author carried out this experiment and to whom he owes an incalculable debt of gratitude. Professor Thomson's appreciation of the work and the high opinion that he expressed about it have been a source of great pleasure to the author.

As the present study was a basic study, it was necessary to make it as thorough as possible. Unless we in India have a reliable foot-rule of mental measurement to start with, we cannot undertake other researches. For instance, if we want to test the efficacy of any method of instruction, we are required to make two experimental groups of children equivalent to each other in every way possible; and since the intelligence of the two groups is the most important factor to be taken into consideration we are required to give a reliable intelligence test to the two groups. Further, the diagnosis of mentally backward children, which is such a vital question for school authorities to consider, can only be done satisfactorily by an individual test of the Binet type. Finally, the author feels confident that as the reader reads through this book carefully many problems for further research will suggest themselves to him, not to mention those that are directly suggested during discussions in the body of the book. Thus the importance of this basic study of the intelligence of children in India led the author to undertake and complete this experiment in spite of various difficulties, not the least of which was the financial one.

The present book gives the results of the experiment, its historical background and the psychological interpretations of the tests. The actual tests which are to be administered in the language of the children have been published separately by the

same publishers in the form of the two books; *Hindi Hudugara Buddhimâpanavu* in Kannada, and *Hindi Mulânchen Buddhimâpan* in Marathi. It is hoped that all these books, which should be read together, will be found to be of great use by educational authorities, by primary and secondary school teachers, and particularly by students of the primary and secondary training colleges. The tests are individual Binet tests as revised by the author from the Stanford version of Professor Terman and it is admitted on all hands that the Binet tests are the most reliable tests of intelligence, though they take more time to administer than group tests.

In this experiment altogether 1,074 children and adolescents of all ages from 2 to about 20 and of both sexes were tested, and the details of the experiment are given in the body of this book. A great many people helped the author in the course of the experiment, the headmasters and headmistresses of schools and the municipal authorities as well as teachers. The author thanks all these people and regrets that for want of space he cannot mention all their names. He wishes to mention, however, Miss K. Laxton, Lady Superintendent, Training College for Women, Dharwar, and her assistant Miss Y. D. Nadkarni for their ungrudging help in several ways while he was testing the girls of the Practising School and the A. V. Girls' School attached to the above institution, and Mr G. K. Puranik and Mr M. S. Muzumdar, the headmasters of the Dharwar High School, for giving him all facilities in conducting the experiment. He is also very thankful to his wife, Mrs Ramabai Kamat, for helping him while he was doing the statistical part of the work. During the final stage of the work after the manuscript was written Mrs McKenzie of Wilson College, Bombay, was kind enough to read it through and make several valuable suggestions, for which laborious work the author finds it impossible to thank her sufficiently. It was extremely gratifying to him to note that in every case she took very great pains to understand his point of view before making any suggestions of her own. The author is thankful also to his colleague Miss S. Panandikar for having taken great interest in his work and critically reading the final version of the manuscript. Finally, the author wishes to express his great indebtedness to Doctor John McKenzie, Principal of Wilson College, Bombay, for appreciating the work

and readily consenting to write a Foreword to it. He also takes this opportunity to thank the Principals of the Secondary Training College, Bombay, Mr H. V. Hampton and Mr S. S. Cameron, for readily doing all that they could as Principals of the College in helping him on various occasions.

The author feels greatly indebted to the Vice-Chancellor, the Registrar, and the other authorities of the University of Bombay for securing the opinion of one of the best authorities on the subject in India, whose appreciation of the work gave an added joy to the author as an independent judgement on the quality of his work.

Once more the author wishes to acknowledge his indebtedness to the University of Bombay for the substantial financial help it has granted towards the cost of the publication of this book. In the same strain he wishes also to thank the Principal of the Secondary Training College, Bombay, the Director of Public Instruction, Bombay Presidency, and the Government of Bombay for appreciating the work and making an equally substantial grant to enable the author to publish it in this form.

Thanks are also due to Professor Lewis M. Terman for permission to use his procedure of giving the Binet tests with the necessary adaptation and to his publishers in England and America.

The author wishes to give a word of warning to readers that though the procedure of giving the tests is treated exhaustively and sample answers are given for most of the tests, the giving and scoring of the Binet tests is really a difficult thing and requires careful training in the technique of testing under an expert. Even after this a teacher or any other worker in the field should not regard the results of his testing as reliable until he has tested about 50 children of different ages.

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CHAPTER I

HISTORY OF MENTAL TESTING

THE Development of Psychology. The study of the human mind has been a subject of perennial interest to philosophers from the time of Plato and Aristotle down to the present day. But the mysterious doings of the mind have eluded all attempts at its analysis. The ancient philosophers tried to do so by observing how their own minds worked. Even today a great many psychologists resort to this method but the trend of modern psychology is to observe the working of the minds of others. More technically, the former type, or method, of psychology is called 'subjective' or 'introspective', while the latter type is called 'objective' or 'behaviouristic'. The development of this latter, or behaviouristic, type of psychology belongs to the last three or four decades.

In the early Greek period, psychology was not recognized as a separate branch of knowledge. Plato wrote on philosophy, but this philosophy included all branches of knowledge, even those which we now call physics, psychology, logic and theology. Aristotle, with his master mind, was the first person to divide Plato's philosophy into physics, psychology, logic, ethics and theology, though he did not use all these terms. But the knowledge comprised by these branches was very meagre in those days and it was only very slowly that the several branches developed into separate sciences and it was not till the Middle Ages that psychology developed into a separate science. In early days psychology, or the science of the mind, was purely abstract or speculative and its laws were based on introspection, that is, the study of the working of the mind by the mind itself. Thus the mind was in the position of both the subject that undertook the study and the object that was to be studied. From a strictly scientific point of view there were many defects in this introspective method, a discussion of which we cannot enter into here.[1] Modern science however required that the objects of

[1] See P. Sandiford, *Educational Psychology* (Longmans Green, 1928), pp. 4-5.

study should be different from the persons studying them so that they could handle and experiment with those objects and formulate their hypotheses or generalizations. This turn was first given to this science with the foundation of the first psychological laboratory at Leipzig, by Wilhelm Wundt in 1879. Since Wundt's time, experimental psychology has made great advances and psychological laboratories have been instituted in all other European countries and in America. Psychology thus came more and more into alignment with the other natural sciences and its laws are being steadily built up as a result of observation, experimentation and generalization, and in the process, subjective or introspective methods are going more and more to the wall, while objective and behaviouristic methods are coming to the forefront. The old speculative type of psychology, with its different schools of thought often diametrically opposed to one another, is disappearing and its place is being taken by experimental psychology, which desires to put everything to the test of rigid experimentation. The method of experimentation was to give a *stimulus* to the subject and to study his *responses* to this stimulus. This was not of course an easy thing to do, as it is with the physical sciences, since mind and its operations are not tangible. Its laws, as in all other sciences where the human factor is concerned, had slowly to be evolved out of the laborious process of statistical calculations. Thus in the earliest times psychology was regarded as a science of the soul and its religious aspect was stressed; but gradually it became simply a science of the mind studied introspectively and the religious aspect was relegated to the theologians, and finally it has become pre-eminently a science of behaviour. To quote Professor Woodworth: 'First psychology lost its soul, then it lost its mind, then it lost consciousness; it still has behaviour of a kind.'[1]

The Development of Mental Tests. The early experiments of Wundt, however, were very different from mental tests as we know them today. They were all concerned with sensory discrimination and motor ability. His great pupil Cattell did much work in this field in America and published in the British journal, *Mind*, his article on 'Mental Tests and Measurements',

[1] R. S. Woodworth, *Psychology—A Study of Mental Life* (Methuen, 1924), p. 2.

1890. Though these tests include some on immediate memory and simple judgement, they are still in the main directed to sensory discrimination and motor movement. An idea of these can be had from the following list of some of his more important tests:

1. Measurement of the strength of grip by the dynamometer.
2. Measurement of the rate of movement of the hand.
3. Measurement of the smallest distance between two points placed on the skin which can be distinguished as two by the individual.
4. Measurement of the amount of pressure necessary to cause pain.
5. Measurement of the smallest amount of difference in weight which can be discriminated.
6. Measurement of the quickness with which a person can react to a given sound.
7. Measurement of the quickness with which a person can name four different colours arranged in miscellaneous order of ten specimens.
8. The accuracy with which a person can bisect a fifty-centimetre line.
9. The accuracy with which a person can reproduce an interval of ten seconds.
10. Immediate memory of the number of consonants spoken to an individual.

The next great landmark in the history of psychology was the publication in 1905, 1908 and 1911 of Binet and Simon's tests of intelligence. We shall see in the next chapter how and why Binet succeeded so well where other experimenters of his time signally failed in their attempts to measure accurately the capacity of the human mind.

Individual Differences. One fact that was found out very early in these measurements was that individuals varied greatly in their performances, and as more data became available, psychologists began to discover the causes of these individual differences. The earliest observation of historical importance was the one which was noted in connexion with an astronomical observation in Greenwich Laboratory in 1795, where one observer differed very much from his superior officer in his record of

the time of the transit of a star and as a result was accused of negligence of duty and discharged from his post. But this was only a case of individual variation. The method employed was first to observe the star till it reached the cross-wires on the field of view of the telescope and then to look at a clock and note down the time. This is then clearly a case of *reaction time*. Later on, astronomers recognized these differences in the reaction time of different people, and further noted that this reaction time was fixed in the case of any one individual. They then began to make allowance for this in what they called the *personal equation*. The reaction time in the case of certain observations made by different people was determined once for all, and this was the personal equation of those individuals—one figure for each individual.

It was not however till careful records were made of these individual differences in Wundt's laboratory by his pupil Cattell that their full significance was recognized. His experiments as noted above were concerned mostly with sensory discrimination and motor movement. As a result of these he was led to believe that individuals varied greatly from one another in reaction time and motor movement. He also pleaded strongly for standardizing the *procedure* in giving the tests and obtaining the norms. Cattell carried on his work of testing in Columbia University and his work was continued by Wissler.

Wissler's Columbia tests and his results were published by him in a monograph in 1901. Most of the tests are similar to Cattell's in that they concern sensory discrimination and motor ability. But three of them measure association, imagery and memory and are thus more complex than the others and resemble Binet's tests. The following is the list of Wissler's Columbia tests:

Length and breadth of head.
Strength of hand.
Fatigue as measured by the dynamometer.
Acuity of vision.
Colour vision.
Acuity of hearing.
Pitch discrimination.
Weight discrimination.
Discrimination of two points on the skin.

Pain sensation.
Perception of size.
Colour preference.
Reaction time.
Rate of perception and reaction as measured by the rapidity of crossing out *a*'s in a given passage.
Rapidity of naming colours.
Rate of movement as measured by dotting in one centimetre squares with a pencil.
Accuracy of movement as measured by striking out dots with a pencil.
Perception of time as measured by the ability to follow rhythm one second after the sound has ceased.
Association as measured by free associations to nine words.
Imagery as measured by the imagery test of Galton.
Memory as measured by four simple memory tests.

Wissler found that the correlation between several pairs of these tests was very small. He further found that the correlation between any one of these tests and the class standing of the pupils was also very small. It was, however, found that the correlation between college marks in the several subjects such as Latin, mathematics, rhetoric, etc. was fairly high. This result is quite in keeping with later researches. Even lower animals do sometimes have greater simple acuity of hearing or of vision; but, when as in man these are complicated by the animals being required to carry these sense impressions in imagination and to compare and contrast them with others and express their judgement, the exercise of true intelligence is required. This means that the simpler the traits measured, such as simple sensory discrimination and motor movement, the smaller the intercorrelation between the traits; also that between each of the traits and general intelligence, as determined by independent criteria such as class standing or the opinion of teachers, and the greater the complexity of the tests, the greater was this correlation. Later on, however, during the development of the Army tests, it was found that when a *team* of such simple tests was used, the combined score correlated more highly with intelligence as determined by independent criteria.

It was left to the French psychologist Binet to find the true solution of the problem of selecting the right type of intelligence test. Without attempting to define carefully what was native intelligence or to analyse accurately mental abilities and devise separate tests to measure these individually, he started by collecting a number of tests from the most common experiences of children and gave them to about two hundred children in Paris. Then he graded the tests according to their difficulty. Thus appeared his first scale in 1905. These tests were further elaborated by him and rearranged in an age scale in his 1908 and 1911 versions as will be seen in the next chapter.

The Study of the Backward and the Feeble-minded. Side by side with these purely psychological studies there were other interests and points of view which tended in the same direction. Sociological interest in the backward and feeble-minded child led to improvement in the methods of diagnosing and treating such children. In early Greek and Roman times it is said that idiots were not cared for by society but were exposed and allowed to perish through starvation. But since the advent of Christianity people have begun to look with pity upon such individuals and to think it the duty of the state to protect them. Whether this Christian spirit of kindliness and brotherhood has been for the ultimate good of society it is difficult to say, because the protection of these individuals encouraged their marriages and hence the perpetuation of the feeble-minded population. The earliest case of a feeble-minded person properly studied was that of a wild boy who was found by some hunters in 1797 in the woods in the Department of Aveyron in Southern France. This wild boy of Aveyron was brought to Paris and aroused the keenest interest amongst the psychologists of the time. They believed that here was a case of a boy brought up in complete ignorance and totally unacquainted with the civilized world. They therefore set about training the child in the most scientific manner. Itard, the pioneer psychologist of the feeble-minded, took up the case and worked hard to educate him. After a long time when he found that he could not bring the child to the level of normal children, he gave up the work, thinking that he was an idiot and uneducable. Itard's work however was very valuable and gave guidance to his pupil Seguin, who devoted himself to the cause of educating the children at the Bicetre in

Paris, a charitable institution for the destitute and the feeble-minded. Thus it was that psychologists slowly began to realize that these feeble-minded children were not a class by themselves, but were only at the lower end of the general population arranged in ascending order according to their mental abilities. The next great landmark in the recognition of individual differences and the diagnosis of mental abilities was the work of Binet, as we have seen above.

The Work of Sir Francis Galton in England. Before we conclude, it will be worth while examining the work done in England in this connexion. During the latter half of the nineteenth century Sir Francis Galton (1822-1911) was engaged in very important studies. Charles Darwin, his senior cousin, was interested in the inheritance of physical characteristics and made out a strong case for the inheritance of such traits. Sir Francis Galton began to investigate whether mental characteristics were also inherited in the same way. His method of investigation was the questionnaire method. He drew up a list of questions regarding the subject he wished to study, for example, the imagery of different classes of people—the scientists, the historians, and so on—and sent these questions to a number of subjects and later collated the results obtained from the answers. He also devised methods of studying the sensory discrimination of different people, for example, weight discrimination by means of a standard set of weights of geometrically ascending order made from empty cartridge cases, and auditory discrimination by means of the 'Galton' whistle, the pitch of which could be altered by the simple device of moving up and down a screw plug fixed in the tube of the whistle. He studied also the family history of 977 eminent people and his studies are recorded in his famous book *Hereditary Genius*, published in 1869. In his book on *Inquiries into the Human Faculty and its Development* he gives circumstantial evidence of various kinds to prove that mental characteristics are inherited just as physical ones. For example, in the domestication of animals man has been successful in domesticating only a few of the wild animals, whose mental characteristics were amenable to such domestication. Sir Francis Galton was also the founder of the eugenics movement in England. The aim of this movement was to study the conditions of healthy society and to devise means by which the

human race could be more and more improved by the elimination of undesirable elements. Only the most healthy persons and persons of strong bodily build and high mental ability were to be encouraged to marry, and the weak, the unhealthy and the imbecile were to be weeded out of society by dissuading them from marriage.[1] Sir Francis Galton's endeavours led ultimately to the establishment of his Anthropometric Laboratory in 1884. In 1901 the Biometric Laboratory was founded by Karl Pearson in University College, London, and was followed in 1905 by the Eugenics Laboratory of Galton. To Karl Pearson goes the credit of expounding scientifically the theory of correlation. His product moment formula for finding correlation is still one of the standard methods of finding the correlation between any two traits.

The Epoch-making Work of Binet. After all these earlier attempts to find an effective method of measuring native intelligence came the publication of Binet's scales of measuring intelligence. Alfred Binet (1857-1911) himself had been experimenting for a number of years seeking in all possible ways to find a true measure. At one time he interested himself in head measurements while at another he studied palmistry, handwriting and physical stigmata. These methods, however, he found disappointing, for they failed to give any clue to real intelligence. His first, or the 1905 scale, was published in an article in the Paris journal, the *Année Psychologique.* It consisted of 30 tests arranged in order of difficulty from the easiest to the most difficult. Though the 'mental age' concept was not developed at this stage, he indicated in a broad way how far a normal child of any age should go up along this scale. He definitely abandoned the idea of analysing and finding suitable tests for the several mental functions. He realized that the workings of the mind were unitary. Hence the more complex the tests the better they tested real intelligence. He therefore collected a number of tests based on the daily experiences of the maximum number of children in various environments and graded them by actually applying them to a number of Parisian children. In 1908 his second scale appeared. This was arranged into groups, age by

[1] Karl Pearson, *The Life, Letters and Labours of Francis Galton, Vol. II* (Cambridge University Press, 1914), pp. 79-80.

age. This is his almost perfect scale of intelligence testing. After the tests were given, the mental age of the child was determined and the child declared as normal or so many months advanced or retarded according as his mental age was the same as, more than, or less than his true or chronological age. This 'mental age' concept is the greatest contribution of Binet to our problem of intelligence testing. Though it now appears to us so simple yet it was indeed a very great advance in the history of intelligence testing. It gave us a clear insight into the development of the intelligence of children as they advanced in age from year to year. It made us realize the fact that a normal child of seven years could not be compared with a normal child of ten years. This discovery, simple as it now appears to us, may be likened to the invention of the first rolling wheel which has enabled us at the present time to construct the most smoothly moving motor-cars. Binet's 1911 scale is very much like his 1908 scale; the tests are spread out more uniformly, a few new tests added and a few of the old ones that were supposed to depend on schooling or instruction were deleted. (For details of these scales see Chapter IV.)

Mental Testing after Binet. Though various revisions have been made and improvements effected in the technique of the procedure of giving the tests and in assessing the results, nobody has yet been able to break away from or discard the Binet tests themselves. This is sufficient proof of the fact that Binet's work was really a great landmark in the history of mental testing. The most important revisions of his scale are those of Goddard (1911), Kuhlmann (1912 and 1922), the Point scale of Yerkes, Bridges and Hardwick (1915) and the Stanford revision of Terman (1916) in America and Professor Cyril Burt's London revision (1921) in Great Britain.

The Group Tests. Since the Great War another type of tests has been developed by a large number of workers. These are the group tests. The necessities of the War required a large number of recruits in America to be tested in a very short time and separated into those fit to be officers, those who could be ordinary soldiers and those fit only to be labourers. The group of psychologists entrusted with this work developed the famous Army tests. Since then an innumerable number of tests have appeared, both verbal and non-verbal. These are, however,

regarded as more mechanical and they lack that personal touch with the subjects which enables the psychologists to obtain a great insight into the working of the minds of their subjects. They are very good for rapid surveys of large populations.

The Scholastic (or School Attainments) Tests.. Side by side with these group tests, a number of what are called educational or scholastic tests have appeared. These measure the educational attainments of school children in the various school subjects, such as English composition, arithmetic, algebra, geography, and science. Norms are obtained suitable to children either of different ages or of different grades, so that other children can then be compared with these norms. (For further details see Professor Cyril Burt's *Mental and Scholastic Tests* or Dr P. B. Ballard's *New Examiner*.)

The Aptitude Tests. After this testing of children was carried on for some time, it was found that children appeared to differ from one another in certain important respects, so that some children appeared to be proficient in certain abilities and others in others. Thus some children were very good at manipulative abilities, some others in abilities involving mechanical devices, still others in musical abilities and so on. Test makers were led to frame such groups of tests designed to make out these several aptitudes—the manipulative aptitude, the mechanical aptitude, the musical aptitude, the verbal aptitude and a few others. It is still not known whether these aptitudes are innate or acquired. Most probably children in very early years develop a taste for one of these abilities on account of the environmental conditions at the time, and this early acquired interest keeps on so that they develop these abilities markedly in a few years. A large number of aptitude tests have thus been developed and they are a great help in the vocational guidance of children.

Tests of Temperament and Character. Finally during the examination of children by means of intelligence tests it was found that their efforts depended not only on their native intelligence, but also on their temperamental characteristics, such as boldness, attentiveness, and interest in the topics. Some psychologists, therefore, began devising tests of temperament and character. Here again it is difficult to say whether these differences are innate or acquired. Today some psychologists claim by their tests to diagnose the temperamental qualities

into such smaller analytical groups as cheerfulness, sociability, humorousness, confident attitude and so on. There are a great many difficulties in devising and objectively rating these tests and hence they have not been as great a success as the pure intelligence tests. We shall use the wider term 'mental tests' to include all the tests mentioned above, the intelligence tests, the educational tests, the aptitude tests and tests of temperament and character.

Performance Tests. In most of the tests described above, language ability—the ability to comprehend another's talk as well as the ability to express one's ideas in speech—plays a great part. This fact puts some children under a handicap. Such is the case with dumb and deaf children and children with some speech defect. For such children performance tests, which do not require the use of language, are developed. In these tests children are required to perform certain activities such as fitting together pieces of wood to form a figure and other similar activities. These performance tests can be given to normal children also, but the experience is that in their case the results from verbal tests are more reliable as tests of general intelligence.

CHAPTER II

THEORY AND PRACTICE OF INTELLIGENCE TESTING

THE Modern Trend in Psychology. As we have seen in the last chapter, since the establishment of psychological laboratories and the consequent stress laid on experimental psychology, our psychological research and psychological laws are following the same lines of progress as the physical sciences. Experiments are being conducted on a large scale: observations are made and recorded; tentative hypotheses are put forward to explain many observed facts; further experiments are carried out to test these hypotheses and finally if the hypotheses stand all these tests they emerge as laws of psychology. The Weber-Fechner law may be quoted as an instance in point. It gives us the relation between the stimuli given to the senses and their effects on these senses. These effects, as found by the ability of a subject to detect them, are proportionate, not to the absolute intensities of stimuli or their absolute differences, but to the ratio of the increase of stimulus to the total stimulus. For example, if a certain subject can detect a minimal difference in weight between 3 grams and 4 grams, he will not be able to detect the difference between 12 grams and 13 grams. The minimal difference required in the latter case will be 4 grams. With 3 grams an increase of 1 gram, that is one-third of 3 grams, was required to be differentiated and the subject is found by experiment to require a difference of 4 grams with 12 grams, that is one-third of 12 grams, in order to differentiate. In other words, the subject in question cannot differentiate between 12 grams and 13 grams, or 12 grams and 14 grams or 12 grams and 15 grams but will begin to differentiate from the next increment onwards, i.e., between 12 grams and 16 grams and so on.

How this Trend has affected the Concept of Intelligence. From very ancient times it was recognized that some men were intelligent and others were dull, but there were no means of ascertaining exactly what this intelligence was or to what extent one person was more intelligent than another. This however

was made possible after attempts had been made to measure human intelligence as we have seen in the last chapter. It was then found that individuals varied greatly in their abilities. An analogy will make this clear. For a long time people saw that men got fever, and when they did their bodies became warmer than those of normal beings. But by exactly how many degrees they became warmer or whether the fever yesterday was more or less than it was today, they could not say; but since the invention of the thermometer, we can say how many degrees and even fractions of a degree a person's temperature may rise. Binet's scale we may thus regard as a mental thermometer, or a mental foot-rule. The application of this scale has enabled us to classify children accurately and to realize that no two children are exactly alike. To illustrate by another physical analogy, if we have a group of a hundred unselected people from the general population, we can arrange them in order of height from the tallest to the shortest. There will be no gaps or sudden descents in heights. Every person will pass on to the next person by a difference of height almost imperceptible, but definite and measurable. The measurement of the minds of a sample of unselected people from the general population gives us a similar distribution and if a sufficiently large number of the general population is tested the distribution curve becomes almost a true Gaussian curve of normal distribution.

This recognition of individual differences was not the only result of mental measurement. Psychologists began to discuss and try to find out what this intelligence is. Is it some innate ability or is it acquired? On this point again thinkers who have observed people carefully have always found that some people are born clever, able to acquire any art or comprehend difficult situations quickly, while there are others who are comparatively more stupid. Modern psychology is not prepared to accept such propositions merely on the ground of hearsay or tradition. It wants to put everything to the test of experiment. It will not accept any general belief or proposition without mathematically measuring its truthfulness. Consequently, a great number of psychologists are engaged in solving such problems as: 'Is intelligence inherited or acquired?' 'Is there such a thing as general intelligence, or is it all specific?' 'Does a mentally superior child continue superior throughout life?' 'Or does

a precocious child deteriorate in later life?' In spite of a good deal of research in recent years opinion is still sharply divided on many of these problems. This is partly because many psychologists still approach such problems with preconceived judgements which give a bias to their findings. It is also partly due to the fact that the operations of the human mind are not predetermined. It reacts to a single situation in various ways. Hence we have to fall back upon the reactions of a large number of people and base our conclusions on the average results of the reactions of those people. In physics or chemistry we know that if a rod of iron is heated strongly it will glow or if dilute sulphuric acid is poured on zinc it will evolve hydrogen. But in psychology we cannot always say that if an orange is presented to a child, it will react to it by eating it; nor can we always say that by presenting the word 'orange' and asking the child to react to it by giving any word that occurs to it, the child will always say 'yellow' or 'sweet'. Such being the case we have to fall back on statistics compiled from the reactions of a large number of people.

Our ideas on the nature of intelligence are slowly modified as a result of our experimental work in psychology. Older definitions are based on introspection and observation, and an analysis of the functions of the mind, while recent definitions emphasize experimental findings. The following are some of the more important definitions. In giving Binet's definition Terman says: 'Binet's conception of intelligence emphasizes three characteristics of the thought process: (1) its tendency to take and maintain a definite direction, (2) the capacity to make adaptations for the purpose of attaining a desired end, and (3) the power of auto-criticism.' In this connexion Binet and Simon also say: 'It seems to us that in intelligence there is a fundamental faculty which is of the utmost importance for practical life. This faculty is judgement, or good sense, practical sense, initiative, the faculty of adapting oneself to circumstances.'[1] William James calls it the ability to adjust oneself successfully to a relatively novel situation. William McDougall, in conformity with traditional psychology, contrasts intelligence with instinct and defines an 'intelligent action as one which seems to show

[1] Binet and Simon, *The Development of Intelligence in Children* (Kite's translation, Training School, Vineland, New Jersey, 1916).

that the creature has profited by prior experience of similar situations, that it somehow brings to bear its previous experience in the guidance of its present action. Instinct is native or inborn capacity for purposive action; intelligence is the capacity to improve upon native tendency in the light of past experience.' Ebbinghaus says: 'Intellectual ability consists in the elaboration of a whole into its worth and meaning by means of many-sided combination, correction and completion of numerous kindred associations. It is an activity of combination.' Stern defines it as 'the general capacity of an individual consciously to adjust his thinking to new requirements; it is general adaptability to new problems and conditions of life'. Thorndike says: 'We may define intellect in general as the power of good responses from the point of view of truth or fact.' Colvin defines it in terms of behaviour and calls it 'a group of innate capacities by virtue of which the individual is capable of learning in a greater or less degree in terms of these innate capacities with which he is endowed'. Terman says: 'An individual is intelligent in proportion as he is able to carry on abstract thinking.' Burt defines it as 'the power of readjustment to relatively novel situations by organizing new psycho-physical combinations'. In another place he defines it as 'an inborn all-round mental ability'.[1]

Perhaps the most astounding definition and one that has given rise to a good deal of discussion and educational research is that of Professor Spearman. He says that all our performances are the result of two factors in intelligent behaviour. One is a general factor and the other is specific. It is this general factor, or 'common central factor', that measures native intelligence. Thus when we respond to any situation or perform an action, our general mental efficiency is responsible for part of this reaction and our specific ability in that particular subject is responsible for the rest. Our performance in a physics paper for instance is due partly to our general intelligence and partly to some kind of special ability in physics which we somehow possess. Or to give a physical parallel, our proficiency in cricket is due partly to our general physical development and partly to the particular kind of configuration of bone, muscle and nerve that is helpful in cricket. The general factor he calls 'g' and the specific factor 's' and he has worked out a formula to determine how far any particular test

[1] Cyril Burt, *Mental and Scholastic Tests* (P. S. King, 1927), p. 199.

measures 'g' and how far it measures 's'.[1] There is a good deal of truth in Spearman's contention, though in practice it is very difficult to separate the 'g' and the 's'. Professor Godfrey Thomson with great mathematical acumen has challenged Spearman's interpretation and holds that 'g' and the specifics are statistical co-efficients only. It will be seen that many of these recent definitions of intelligence are a result of direct experimentation with the intelligence tests. As contrasted with Spearman, Thorndike contends that intellectual ability consists of the power to form numerous 'bonds' and each situation requires a bundle of these bonds or elementary capacities. He would deny that there is any 'common central factor'. During the present revision, while giving the tests and receiving the responses from children, the nature of intelligence was found to be the power to hold together in mind all the elements of a presented situation and with the aid of these and of the previous associative mass or pattern to give a suitable response.

The Nature of Intelligence. We shall discuss the nature of this intelligence in a little more detail. Anybody who examines children by means of intelligence tests cannot fail to observe that some children are naturally adept in handling any kind of questions or tests, and that others are very backward in doing so. Present one child with any kind of question of a particular level and the child will tackle it successfully, while another child of a lower level will fail to do so; and as you proceed with the tests you can almost definitely foretell whether a particular child will answer the next questions or not. This clearly suggests that the working of the mind is unitary. At any rate this is so with the Binet tests. Besides, as we have seen in the last chapter, early attempts to gauge intelligence by tests such as the sensory discrimination and motor ability tests which differed widely from each other failed, because it was found that they did not correlate highly with intelligence as determined by other more reliable criteria. On the contrary it was the more complex tests involving the exercise of the higher mental processes that were found to be the best. They correlated highly with intelligence as well as with each other. Thus in the development of the Army tests the earlier attempts aimed at finding tests that correlated as little as possible

[1] C. Spearman, *The Abilities of Man* (Macmillan, 1927), p. 75 and Appendix at the end of book.

with each other and at the same time correlated highly with external valid criteria of intelligence. But experiment proved that this attempt was futile. Tests which correlated highly with criteria of intelligence also correlated highly with one another. It was just because of this that Binet succeeded so well while previous workers who tried carefully to analyse the mental functions and devise separate tests for these functions failed. He found as a result of his experimentation that there was no other way for him but to abandon the so-called faculty psychology. With wonderful insight he began to assemble tests that were of a complex nature. Of course he did select different kinds of tests to suit the practical activities of children in different environments, and to ensure that no injustice should be done to any of the children. He took care, however, to see that the tests were within the common experience of all kinds of children. This method of Binet seems to suggest as we said before that the operations of the mind are unitary. Here again the physical parallel is of great help to us in understanding things correctly. The bodily efficiency of a person required for any physical activity such as wrestling or playing cricket depends on the whole muscular system of the person. So if we wish to measure this efficiency it will not do for us simply to measure the strength of his arms or that of his legs. Such activities generally depend on the efficiency of the whole of the muscular system. However much the muscles of the arm of a person be developed, he will not be a good wrestler unless the muscles of his leg and those of the trunk are also well developed. In fact, the various muscles of the muscular system are interdependent. Hence if we have to test the bodily efficiency of any person we shall arrive at a more accurate result the more complex the activity involved in our test. It will not suffice if we use a test involving only the muscles of the fingers or the muscles of the jaws. We should select tests which will involve as large a number of the major muscles of the body as possible. For example, we should measure how far the person jumps, how high he jumps, what time he takes to run 100 yards, or a mile, and so on. Similar is the case in regard to our mind, whose workings are far more mysterious. Even if we tried, it would be almost impossible for us to analyse mental traits into ultimate unanalysable units. This practical solution also agrees very well with the known

facts of physiology. The higher mental processes are known to be carried out by what are called association areas in the cerebral cortex. A man's acuity of vision may not correlate highly with his acuity of hearing because these activities are carried out in independent regions in the brain; just as the efficiency of the muscles of the arms of a man may not correlate highly with the efficiency of the muscles of his legs. But those processes in which the association areas are concerned are highly correlated. These facts have led intelligence testers to conclude that there is some central factor in all our mental activities which is responsible for the efficiency of our responses. It is for this reason also that Spearman contended that this general factor is fixed in the case of each person and is involved in all our thoughts and doings. Spearman's theory more specifically is that all our mental activities or doings are the result of two factors, a general factor which he calls 'g' and a specific factor which he names 's' as stated above.

The Measurement of Intelligence. This discussion will now make it clear as to what are the difficulties that beset us in the measurement of intelligence. In the first place it is very difficult to separate pure native intelligence from acquired knowledge. Native intelligence always manifests itself through acquired knowledge or skill or action. Pure abstract intelligence does not exist. It always requires as it were a vehicle on which to ride. Now these vehicles are of various kinds. Different environments or different opportunities give different directions to mental activities. Hence we are forced to measure this pure intelligence through the medium of these different vehicles. Now the question is, which of these vehicles shall we choose? If we choose only a few of these are we sure that we have given a full opportunity to a child to display his intelligence? The answer is that it is impossible for us ever to be mathematically accurate. But when we consider the question from all points of view we find that Binet's method of approaching the subject was the right one. The three great points in the assembling of his tests are, first, that they are selected from the most common experiences of the children of various environments. Secondly, they are as varied as possible. Lastly, they are not measures of various elementary faculties, but of the higher powers of the mind. Earlier experimenters tried to obtain different tests for different

abilities and failed. They attempted to find tests which would have high correlation with valid outside criteria of intelligence but at the same time had a low inter-correlation among various tests themselves. Such a procedure was found to be impracticable. The most successful procedure was found to be to select tests which had high correlation with outside criteria of intelligence and these were found to be those that had also high inter-correlation among themselves. Again Binet's attempt to measure intelligence was the most practical one. Before him many experimenters had tried to measure it by taking various kinds of head measurements. But Binet rightly thought this could never lead to correct results. He tried to measure efficiency of the mind by measuring the actual amount of work turned out by the mind. Even in such a simple thing as finding the efficiency of an engine the most reliable results are obtained by measuring the actual output of work of the engine. Of course we can find it also by measuring the area of the piston, the length of the stroke and the pressure of steam and so on; but the figure so arrived at may give widely differing values. The more reliable values are obtained by measuring the actual output of work. If this is the case in such a simple thing as a physical engine, how much more forcible in the case of such a mysterious engine as the human brain or human mind is the argument in favour of measuring intelligence by its actual output?

But the height of Binet's genius is shown by his invention of the age scale. Previous to him experimenters met with the difficulties of how to arrange the tests according to their difficulty and at the same time how to find suitable tests for different years. Binet solved this difficulty by saying that a man may be 16 years of age and at the same time may have the intelligence of a boy of 8 years. In fact he proved such an adult person to be exactly equal to a child of 8 years. Later researches showed that Binet was to a large extent right. Just as some physical characteristics at times are found not to develop with chronological age, so also it was found that mental development did not always keep pace with chronological age. Rather it was found that a child of lower endowment always advanced on a lower level and a child of higher endowment on a higher.

On the question of the development of intelligence in any individual there has also been very great discussion. Does

this intelligence grow uniformly from year to year? Or does it grow at a greater pace at certain periods of an individual's growth? Is there any limit to the growth of intelligence? If so at what age does it come? Does it come at the same age for all individuals or do some individuals continue to grow in intelligence for a longer time, that is to a greater age than others? As regards the growth of intelligence from year to year it is still undecided whether the growth follows the law of simple interest or that of compound interest or some law of diminishing returns.[1] At present we have no means of measuring this as we have no absolute measures of intelligence similar to the inch or pound in physical measurement. Our present method is to measure intelligence by comparison; we compare any child with the average child of that age but we have no means by which to decide whether the growth of each child follows any of the above mentioned laws. In all cases the result would be the same since we make comparisons among children who have all grown one way or the other, and not between a child of a higher age and one of a lower. We cannot find out how many times more intelligent a child has grown after one year or two years. This would have been possible in a test like repeating the digits. But here it appears that there are other factors which have greater weight than mere organic growth. The case is more like a balancing feat. The higher the point you reach the greater the difficulty of balancing and much more than the proportion would require. Thus at $2\frac{1}{2}$ years of mental age a child repeats two digits; at $3\frac{1}{2}$ years 3 digits; at $5\frac{1}{2}$ years 4 digits; at $7\frac{1}{2}$ years 5 digits; at 11 years 6 digits; at 15 years 7 digits; at 21 (mental age) years 8 digits. For the same reason, we have no means of measuring directly whether the growth is more rapid at certain periods than at others, as for example at adolescence. At the most we can have only some circumstantial evidence, as, for example, by finding how much more widely one age group is scattered about the mean of the group than another. The third question on the limit of growth of intelligence, however, can be definitely answered by means of intelligence tests. We find that after a certain age the score made by children comes almost to a standstill. Or, to put the same facts in other words, the percentage of children that pass a certain test remains

[1] For a discussion of physical and mental growth curves see Arnold Gesell. *The Mental Growth of the Pre-school Child* (Macmillan), pp. 15-20.

nearly constant from, say, the sixteenth year onwards.[1] In fixing the upper limit of growth of intelligence by means of tests, care must be taken however to see that the tests at the upper end are sufficiently hard. Otherwise if they are easy enough to be answered by cent per cent children of, say, the twelfth year, we will not be in a position to distinguish between this group and the higher groups. There is, at present, no unanimity on the point as to the age when this limit of growth is reached. Some say it is reached at 14 years, others at 16. Others again think that there are reasons to suppose that intelligence grows still further, though more slowly, till the eighteenth or even the twentieth year. If it grows after the sixteenth year at all, it appears to grow very little. This is mainly determined by the score which boys and girls make in tests from year to year. It is found that after the sixteenth year there is very little increase in the total score made. Thus the average score of children of sixteen years of age and the average score of adults of twenty-five will be practically the same. The table on page 22 based on the present study gives the mean mental ages of children of all ages from the third year onwards. The mental age is a form of the total score children make.

It will be seen that the mental age is practically at a standstill from the year 15-16 onwards. The apparent fall from the year 18 onwards is due to the fact that the adolescents of these ages in the highest classes of our high schools are some of them 'left-overs'. Normal adolescents have all either proceeded to university education or left school. In all our subsequent calculations we have, therefore, taken 16 years as the limit of growth, which does not seem to be far from truth.

On comparing these facts about mental growth with the available data on physical growth, in which field we have definite absolute units such as the inch or the pound, we cannot fail to notice a parallelism of growth on both these sides.[2] The physical growth as well as the mental growth comes practically to a standstill about the sixteenth or the eighteenth year. The increments in height and weight per year are more or less

[1] See Chapter V, pp. 58-61.

[2] For average increases in height and weight from year to year, see Whipple, *A Manual of Mental and Physical Tests*, Part I, Second edition, 1914, pp. 66 and 75.

Chronological age	No. of children examined	Mean mental age
2 to 3 years	31	2.7
3 to 4 ,,	41	3.6
4 to 5 ,,	38	4.5
5 to 6 ,,	65	5.4
6 to 7 ,,	63	6.4
7 to 8 ,,	94	7
8 to 9 ,,	82	8.7
9 to 10 ,,	80	9.4
10 to 11 ,,	101	10.6
11 to 12 ,,	95	11.3
12 to 13 ,,	84	12.7
13 to 14 ,,	81	14.1
14 to 15 ,,	56	14.3
15 to 16 ,,	57	15.7
16 to 17 ,,	45	15.8
17 to 18 ,,	23	16.2
18 to 19 ,,	12	15.8
19 to 20 ,,	12	14.8
Above 20 ,,	7	14.8

constant from about the fourth year to about the eighteenth year, although a slightly steeper rise is noticeable between the twelfth and the sixteenth year. We may assume by analogy, for the present, a similar growth increment on the mental side and say that in any particular individual a growth of one year at twelve is about equal to a growth of one year at four; and further that the yearly growth of a child of an I.Q. of 125 is one and a quarter times the yearly growth of a child with an I.Q. of 100 (see next chapter).

CHAPTER III

USES OF INTELLIGENCE TESTS

SINCE the introduction of mental tests immense use has been made of them by the school teacher, the school administrator, the vocational counsellor and the vocational selector. A vast amount of research work is going on in all these fields. Our educational ideals are being almost revolutionized as a result of these. We shall, therefore, briefly survey in what way intelligence tests as well as other mental tests[1] are being used by various people.

Educational Uses of Tests. In the first place these intelligence tests are of very great use in the school. If a teacher is to be successful, if he is to know his pupils thoroughly, he must possess an instrument with which he can measure the intelligence of his pupils and he must also know the proper use of that instrument. His is the work of handling young growing minds. He must, therefore, know as much as possible of these minds. He must know exactly the present condition of these minds as well as their future possibilities. He can no more diagnose and treat these minds accurately without being in possession of an accurate instrument of mental measurement than can a doctor diagnose and treat the physical condition of his patient without the use of a thermometer. Of course he can know something of the condition of the minds of his pupils from a record of their studies, just as a doctor can know something of the condition of his patients by observing the temperature of their bodies by feeling them with his hand from day to day. But in both cases the information gathered is incomplete and unscientific. For the proper handling and treatment of both kinds of cases we require instruments of far greater precision. Such an instrument for the teacher is Binet's rod of mental measurement. With this he will be able to find out the exact calibre of the minds of his pupils. If a child is backward in studies he will be able to discover whether this

[1] *Mental tests* is a wider term than *intelligence tests*. The former includes, besides intelligence tests, educational attainment tests, tests of temperament and character and vocational tests.

backwardness is due to the child's neglecting his studies, or to his youth, or whether, though sufficiently advanced in age, the child's mental development has been retarded. Knowing this much, which it should be remembered is the most valuable part of his knowledge about the child, the teacher will be able to apply the proper remedial measures.

We shall now see in what ways these mental tests can be made use of by teachers and school administrators. In the first place, children of very low mental calibre, for example those with an I.Q. below 60, might be separated out and special arrangements made for their education in special schools for the mentally retarded or backward children. Secondly, specially advanced or gifted children, those with an I.Q. above 140, might in the same way be separated and specially trained as they are the most valuable assets of a nation. This will not be possible however, except in large cities with a population of school-going age of at least 20,000, because such children form about 1.5 per cent of the total population of children (see p. 84). In smaller towns the number of such children will not be enough to form even one class in each standard. Lastly, even the children between these two limits of I.Q.s, those between 60 and 140, could be divided into two or three parallel streams, especially in large schools, where there is a sufficient number of children to admit of such division, and where different curricula could be arranged for them, and they could be made to progress onwards in these parallel streams.

The question may here be asked, is it not possible to gauge the intelligence of children without the use of mental tests? We must answer, No; and this for several reasons. In the first place, teachers in estimating the intelligence of children do not take into account their age. They judge their intelligence solely from the marks obtained by them in their school subjects. A child of 10 years and another of 12 years may be put on the same level if they obtain the same number of marks. Thus the intelligence of an older child in a lower standard is always over-estimated and that of a younger child in a higher class is under-estimated. This procedure is evidently incorrect as the child of 10 years is very much superior to the child of 12 years in our above illustration. Secondly, progress in school subjects is not a correct method of estimating intelligence. One

child may be comparatively dull but more industrious and thus may score more marks than another child, who may really be more intelligent but less industrious. The Binet tests which do not depend on knowledge that is systematically imparted to the children in school, but which depend on such general knowledge as they pick up from within their everyday experiences and in proportion to their mental development, are a far better measure of native intelligence. Lastly, in the assessing of children's progress in their school subjects by their teachers, a good deal of the subjective element creeps in, so that a child in whose favour a teacher happens to be prejudiced secures more marks than another who is not so favoured.

Next we shall consider some of the difficulties that arise in trying to separate children into different streams or divisions in a large school. Are the children to be classified according to their I.Q.s or their mental ages? It would appear that the best way to classify them is according to their mental ages. For a child may have a high I.Q., say 125, yet his mental age may be too low for the standard in which he is and he may be doing poor work. Another child of a lower I.Q., say 100, may have a higher mental age and may be doing much better work in the same class. Hence in classifying children it is the mental age that is more valuable than the I.Q. It would appear that for each standard or grade there is one mental age that is normal.[1] Thus in admitting children for the first time into school the proper way would be to admit them on the basis of their mental age; so that all children in the lowest class will be of the same mental age, say 6. Even then another difficulty arises. A backward child and an advanced child do not advance by the same amount of mental age every year. A perfectly normal child may be said to advance by one year of mental age per chronological year; in the same time a backward child may advance by, say, 9 months, and an advanced child may add more than one year to his mental age. Thus if a normal child advances by 4 years in 4 years of time, a retarded child may advance only by 3 years and an accelerated child may advance by 5 years. Thus, though they may start together at the beginning of their careers it will be seen that in a few years their

[1] See Chapter V, p. 78.

progress will be quite different. In the present instance it will be seen that while the backward child will probably have to be detained for one more year, the advanced child will similarly deserve an additional promotion of one year.

Besides these theoretical difficulties there may arise various practical difficulties. The progress of different children of the same mental age may not be the same in different subjects, for a child may develop a special aptitude or liking for one subject rather than for another and the result will be a vast difference in the progress he makes in the two subjects. Or again, traits of temperament or character may play an important part in the efforts put forth by children. One child may be very persevering and thus overcome the difficulties in his way and far surpass another child who is more unsteady in his efforts. Again the physical condition of children has to be taken into account. One child may have a fine physique and thus be capable of putting forth more effort than one of a weaker condition. Similarly home environments may differ very widely. One child may have all the facilities for study, may be in possession of a good library and get good guidance at home, while another may come from a very poor home, where there are no proper facilities and where he may even have to help the parents in their job-work. The circle of friends among whom the children move makes a vast difference also in the work they turn out. Thus even if we start children at stages suited to their mental ages, we shall soon find that this uniformity will not be maintained. This will teach us the lesson that we should not be over-zealous in classifying children according to their mental ages. In every case we should consider the situation in all its aspects.

It will thus be clear that even if we start by putting children of nearly the same mental age into the same class, we shall soon have to differentiate between them, for some children advance more rapidly than others. Two courses are now open to us We can make the brighter children pass over certain standards or else make them work with the others in the same class but on a fuller curriculum. In the latter case they advance according to the one-year-one-standard rule; but in this one year the bright child reads more on the subjects prescribed than a more backward child. For example, in mathematics, the bright child may

work out 50 examples in each chapter while the backward child may be satisfied with only the first 30, supposing the examples in the chapter are on the same subject but are graded in difficulty. In history, the brighter children may be prescribed a supplementary textbook on the subject that will satisfy their greater inquisitiveness. This method seems to be favoured by the larger number of educationists; and certainly it has several advantages over the other method where children are made to pass over standards or grades, for here the child loses a good deal of the studies that form regular links in a well-arranged curriculum. Secondly, the child has to break the bonds of association already formed with his classmates and has to form new friendships. Thirdly, he may come into contact with children older than himself in age and may find that he is a misfit in their company. Thus it is found in very many cases that the social and physiological development of children is quite apart from their mental development. This maladjustment of children often preys upon their health, so that in later life they may develop complexes or become physical wrecks. To avoid all these difficulties it seems to be best, as a general rule, to provide a richer curriculum for the cleverer boys and make them pass annually through the regular standards or grades. In exceptional cases where the cleverest children are to be trained for special advanced professions or competitive examinations for the highest civil services, they may be permitted to omit one or two standards or grades during their career, provided they possess exceptionally good health and are strong enough to bear the extra mental burden. In such cases, however, they will have to be carefully examined mentally and given the extra promotion only if their mental age is not less than the normal mental age of the class to which they are to be promoted.

Occasionally there may be in a class a few cases of children who, while capable of advancing with the class in most subjects, are found to be lagging behind in one or two. Such children require special attention in order to be brought up to the level of the rest of the class. This can best be achieved by segregating such children in an *opportunity class*, where they are given special instruction in these subjects and when the desired efficiency in the subjects is reached they can be sent back to the regular standards. It is the duty of the head of the institution to provide

such instruction for deserving backward children. In all these cases a mental test would seem to be necessary before proper treatment can be given.

The Accomplishment Ratio. Following up the idea of intelligence tests, tests have been devised to measure the achievement of children in the several school subjects. These tests, for example, in algebra or arithmetic or science, are given to children and norms are obtained both according to age and standard or grade. A composite score called the Educational Quotient (E.Q.) may be obtained for all the school subjects. Thus $\text{E.Q.} = \frac{\text{Educational Age}}{\text{Chronological Age}} \times 100$. If a child is above the average in intelligence, that is, if his I.Q. is above 100, it is expected that his E.Q. should also be above 100. If it is less, it means that the child is not working up to his natural level. If it is more, the child is being goaded too much. From these may be worked out what is called the Accomplishment Ratio. Thus the $\text{A.R.} = \frac{\text{E.Q.}}{\text{I.Q.}} \times 100$. If the child's educational quotient is 80 and his intelligence quotient is 100, his accomplishment ratio will be 80. This means that the child is not working up to his capacity. On the other hand, if the child's E.Q. is 120 and his I.Q. 100, his A.R. is 120, which means that the child is working much beyond his powers. The attainments of the child in the individual subjects may in the same way be compared with his intelligence quotient. With the educational quotients, however, there is one difficulty. The standard laid down in the different subjects of the curriculum may differ in different countries or provinces or with different times. The standardized norms, therefore, will not be valid in such different localities or different times.

Individual Methods in Education. The findings of intelligence tests and the recognition of individual differences have brought about almost a revolutionary change in our methods of instruction. The old classroom methods of uniform instruction are going more and more to the wall and methods giving full scope for individual development according to the ability of each child are coming to the forefront. Such are the Dalton Plan, the Courtis Arithmetical Cards, and Professor Washburn's course

in arithmetic. What has been actually accomplished hitherto is far short of what is required to be done. Textbooks have to be written in all subjects to suit the requirements of individual progress. It is fully recognized, as it was recognized at no other period in the history of child education, that no two children are exactly alike and that each child should develop according to his own worth and merit. This has also given a sociological aspect to education which recognizes that each individual has a place in society and is a necessary member of it no matter how poor he may be in native endowments. Society requires the use of hewers of wood and drawers of water no less than that of the brightest gems.

Results of One Mental Test should be Checked by Another. Wherever possible the result of one test, particularly that of a group test, should be checked by another kind of test. There is sometimes the danger that a child for lack of application, or through inattention, shyness, timidity, or selfwill, does not try his best or he may waste a good deal of time and thus lose a good deal of his true score particularly in a group test. It is always best, therefore, to check up the result of one kind of test, in particular that of a group test, by an independent individual test. Similarly these verbal tests sometimes need checking up with performance tests. The maximum score in I.Q. should be taken as more reliable than the minimum.

Vocational Guidance. Another important use of these tests is in vocational guidance. The teacher or the parent or the officer in charge of the work of vocational guidance will have to guide children properly as to what course or profession they should follow. The first index towards a suitable profession is given by the child's intelligence test. The intelligence quotients of all children are carefully recorded. For each profession or trade the minimum I.Q. required for successful work is determined by the actual observation of successful workers. Thus for university teachers and the legal profession, men of the highest intelligence are required, men for example above I.Q. 120. The skilled trades and the clerical professions require men of medium intelligence. Unskilled labour may use men of the lowest I.Q., even men below I.Q. 80. Psychologists[1]

[1] See, for example R. B. Cattell, *Your Mind and Mine* (Harrap, 1924), p. 273.

have attempted to catalogue the minimum I.Q.s required for the various professions and with this knowledge at hand we can direct boys as to what line they should take. Thus it will be useless for children with I.Q. below 80 to attempt any of the higher professions. After this preliminary survey other occupational tests are given to the children in order to discover their special aptitudes or likings. For example, for the business of typewriting, tests are devised which are supposed to be elements in the total ability of typewriting. Such occupational tests are devised in three ways. In the first place, the particular profession or work is carefully analysed into the constituent abilities required and tests are devised for each of these abilities. The scores in each of these abilities are correlated with success in the particular trade or profession and in this way only those abilities that correlate highly with the trade or profession are retained. Thus Seashore has analysed musical aptitude into 32 elementary abilities and has devised tests for each of these. He then finds a composite score for all these abilities which represents the individual's musical aptitude.

The second method is to devise a test which would be a miniature of the actual trade or profession. For example, Munsterberg has devised a test for electric-car drivers. Through an aperture in front of the candidate a road track is rapidly passed in bright light; figures representing foot-passengers, horse-carriages, motor-cars and buses are rapidly moving in two opposite directions. The candidate is required quickly to indicate which of the figures representing foot-passengers and various kinds of vehicles are sources of danger.[1]

Lastly, candidates are tested by giving them practice in the actual activity itself. For example, in testing for typewriting ability the same amount of practice is given to different individuals and their progress in the fixed time measured. This progress is an index to their future improvement in that particular kind of job.

Guidance for vocations is given mainly on the results of intelligence tests. These are considered along with a carefully kept record of the candidate's progress and conduct including his various temperamental characteristics and inclinations.

[1] Hugo Munsterberg, *Psychology and Industrial Efficiency* (Houghton Mifflin, 1913), pp. 69-72.

But for vocational selection the employer is not satisfied with these alone. The special aptitudes of candidates are further tested by means of specialized occupational tests as indicated above.

The Stage at which Vocational Guidance should be Given. It is common knowledge that a good many children drop out of school and students out of colleges at various stages in their progress. This observation is supported by the findings of intelligence tests. Some children cannot complete even the elementary course, some cannot reach the top of the secondary course, while a few more who persevere to the university stage have to drop out in the middle of these studies. The question then arises as to what are the duties of the parents and the state with regard to these students. It is here that the help of experts in vocational guidance would be of great use. In the case of some children the barest minimum of the three R's would be sufficient, equivalent roughly to the present primary fourth standard course of the Bombay educational department. This course, however, should be followed up with specialized instruction in the trades the children might follow. For others, courses of study to about the middle of the present secondary school course would be enough. This general course should again be followed up with specialized instruction in the trades higher than the lowest. Finally after the completion of the high school course there should be further courses of a more highly specialized nature, such as technical courses in many of the highly skilled trades. The best children after the high school course will proceed to their university studies. It is the duty of every state to provide some such scheme of education if it regards as of the utmost importance the care of all its subjects. The greatest thing in life for everyone is to be able to earn a livelihood. The selection of a vocation cannot be left entirely to the children themselves or to their illiterate parents, because more often than not the schemes of children are more ambitious than it is humanly possible for them to carry out. They are therefore in need of guidance. Such guidance it is the duty of the state to provide. There are many people in good employment who still wish to improve their work and condition. It is again the duty of the state or of local authorities where the duties of the state are entrusted to them, to provide a scheme of continuation schools,

evening classes or other forms of adult education. If the employees are not satisfied with their lot or with the return they get for their work, the work suffers. The employers, therefore, should keep a careful record of their employees and promote or otherwise reward such of them as deserve promotion.

Factors of the Mind. Since Spearman propounded his Two-factor theory and claimed to prove it by mathematical analysis, other psychologists, particularly L. L. Thurstone in America, worked on this problem and a great many of them now claim that there are not simply two factors in all our activities, one general and one specific, but that there are some important group factors as well in these activities. These group factors are present in certain groups of tests, to which they are common. A verbal factor, *v*, they claim is present in tests involving verbal ability. Similarly there are other group factors analyzed, such as the numerical factor, designated *n*, a practical factor *F*, and a few others. If there are only a few of these factors and we can isolate them in the abilities of individuals and also in certain vocations, it is claimed that we could guide individuals for their vocations with a great deal of certainty. Some psychologists doubt, however, whether we will succeed in isolating a few orthogonal, that is uncorrelated, and psychologically meaningful, factors. On the other hand if the number of factors analysed becomes very large, their utility becomes proportionately less. In the words of Sir Godfrey Thomson, 'The fundamental advantage hoped for by the factorist seems to be that the factors may turn out to be comparatively few in number, and may thus replace a multitude of tests and innumerable occupations by a description in these few factors.... This, if achieved, would react on social problems somewhat in the same way as the introduction of coinage influences trade previously carried on by barter.'[1] In this way we see that although the faculties of the old psychologists have proved to be a myth and the working of the mind has been found to be unitary, in recent years these factors of the mind are trying to come forward as new aspects of mental activities. Spearman expresses these facts humorously in the following words: 'The faculties, like the British people, have a way of losing every battle, but ultimately winning the war.'

[1] Godfrey H. Thomson, *The Factorial Analysis of Human Ability* (University of London Press, 1950), p. 118.

CHAPTER IV

THE BINET-SIMON SCALE AND THE STANFORD REVISION

PRINCIPLES of Vital Importance in the Choice and Arrangement of Tests. From what we have seen so far it will be clear that in framing a scale of intelligence tests the following points are of vital importance:

(i) The tests should be as varied as possible in order to 'tap' the flow of mental energy in various directions. Binet's solution in this respect was found, from practical experience, to be the best. Some of his tests are on memory for syllables having sense; some on auditory memory for digits; some on visual imagery; some on comprehension; some on judgement; some on arithmetical reasoning; some on ability to pick up and learn from everyday experiences, and so on.

(ii) The number of tests which any individual child should be submitted to should neither be too large nor too small. In Binet's arrangement each child will, on an average, be subjected to 20 tests, some of these having 2 or 3 sub-tests; that is, to a range of tests covering 4 years, with 5 tests in each year. In the present arrangement he will be subjected to about 24 tests; that is, to a range of 4 years, with 6 tests in each year. If the number of tests is too small the reliability of the I.Q. becomes less on account of the small number of tests; while if it is too large it becomes so owing to the effects of fatigue that creep in. The testing on this scale takes from half-an-hour to nearly two hours according to the age of the children. The tests of younger children are shorter, and their replies brisker; the tests of older children are longer and require more time owing to the greater judgement required in finding proper solutions to the questions.

(iii) The wording of the questions in the test should be within the range of comprehension of the children of the ages for whom they are intended. On several occasions it is found necessary to replace individual words by others, when the former are found to lie outside the vocabulary of the children to be tested.

(iv) The questions should be unequivocal and should admit of a definite answer not necessarily the very same. In group tests most of the answers are either a definite word or a definite figure. This makes the assessing of the answers more objective and removes many of the evils that attend the idiosyncrasies of different examiners, or the prepossessions in favour of certain children in the case of the same examiner. These answers are generally checked with the help of a stencil or a key. In the case of an individual and oral examination such a condition is not necessary. More often than not, therefore, the answers are various. They should, however, be suitable and intelligent. This is distinctly an advantage in oral tests since it precludes the possibility of one child communicating the correct answer to the child that is to be examined next. For example, take a question like, 'What is the difference between a butterfly and a fly?' Different children give different answers and all may be sensible. On the other hand, where the answers are definite, the tests are not so valuable. For example, refer to *XVI*, 5, *Problem Questions*.[1]

(v) The questions should give no scope for guess-work. They should stimulate the children to think and to find a suitable answer. When children begin to guess even the intelligent give foolish answers. From this point of view *XVI*, 5, *Problem Questions* are again of no great value.

(vi) The questions should be such as to keep up the interest of the children. If once their attention flags further testing is useless. Anybody who does any testing on the Binet scale cannot fail to be impressed by the wonderful way in which children enjoy the tests. Again and again little children are found to come back and ask for another test.

(vii) The tests as well as the sub-tests should be arranged in such a way that the easier ones come first and lead on gradually to more and more difficult ones. This has the advantage of encouraging the child to do his best and not disheartening and preventing him from making any effort at all to solve the question.

(viii) No two tests of the same nature should come one after the other. In other words, there should be as much variety in consecutive tests as possible.

(ix) The tests should be such as to give no advantage to one child over another because of his better schooling or better home or social environment. It will be seen from what we have said in previous chapters that it is impossible to test the native intelligence of children except through what they have acquired or learnt from their everyday experience. Binet, therefore, was perfectly right in attempting to measure it through the knowledge the children pick up or through the output of their mind which is a true measure of their intelligence. Hence he must have argued that there was no other way for him than to select items from among the most common experiences of children to enable them to manifest the development of their intelligence. Since his tests were published, they have been tried in various countries, in situations widely differing from one another and among people with almost diametrically opposed traditions in the far west and the far east. Under all these varying circumstances the allocation of the tests to the several ages agrees very well. There can be no better proof, therefore, of the great insight and experience with which Binet selected the various items of his tests.

Procedure in Giving the Tests. Next in importance to the selection of the tests comes the procedure in giving the tests. Binet, as quoted by Terman, analyses the methods by which teachers estimate the intelligence of children. Some of them do so from the marks scored by the children in their school subjects, such as arithmetic, reading or history. Others judge it from some out-of-school activities such as resourcefulness in play. Some others suggest asking some 'catch' questions; such as, 'which is heavier, a pound of feathers or a pound of lead?' Certain others again judge the same from the facial expression and the lustre of the eyes of children. But Binet asks, how are we to *standardize* a glance of the eye or an expression of the face, so as to measure the intelligence exactly? Such methods are crude and unscientific.

Binet's method is to lay down the procedure in giving the tests exactly. Every question is definitely worded, so that not a single word can be changed. Every child, therefore, is put in the identical situation. The time that is to be allowed for each question is definitely laid down. After the formula of a question is recited before the child, no supplementary questions

are to be allowed, as is often the tendency of inexperienced testers. The exact method and order of presenting pictures or other test material is laid down. For it has been found from psychological experiments that even a very small change in the procedure, such as putting one picture to the left instead of to the right, makes a vast difference in the responses given by the children. The procedure, therefore, as laid down for each test is to be strictly adhered to. It is then only that the several results are comparable. This procedure in detail will be described in the proper place.

One thing that Binet insists upon, and rightly, is that the child should be taken fully into confidence before the testing starts. He should feel quite free and familiar with the examiner and should be in general in a position to make his best effort. If the child becomes nervous, timid, or self-willed and refractory the testing becomes valueless. From this point of view the individual oral tests are far superior to the group tests. In group tests if the child once becomes nervous the whole time devoted to testing is wasted. Nor can this nervousness or timidity be easily detected. On the other hand such a situation can at once be detected in individual tests. Future improvements in psychology particularly in the case of the younger children, will depend far more on individual psychology and individual testing than on group testing. For it is then that the examiner comes face to face with the subjects and can adapt the circumstances to varying situations and study more minutely the working of human minds.

Binet's 1911 Scale. Binet published his tests in three scales. The earliest, that is the 1905 scale, contained a list of thirty tests arranged in order of difficulty, and a child's mental development was found by noting how far up the scale he could proceed. His 1908 scale was a refined age scale. The 1911 scale was almost the same as the 1908 scale. Only a few tests that were found unsuitable were dropped and the number of tests in each age-group was made five, except in year IV, where there are only four. This makes the working out of mental age on the decimal system very easy. He wanted no doubt to refine his measuring instrument still further in the light of further statistics, but this was left to future workers owing to Binet's untimely death in the same year as the publication of this scale.

The following is his 1911 scale:

Age 3

1. Points to nose, eyes and mouth.
2. Repeats two digits.
3. Enumerates objects in a picture.
4. Gives family name.
5. Repeats a sentence of six syllables.

Age 4

1. Gives sex.
2. Names key, knife, and penny.
3. Repeats three digits.
4. Compares two lines.

Age 5

1. Compares two weights.
2. Copies a square.
3. Repeats a sentence of ten syllables.
4. Counts four pennies.
5. Unites the halves of a divided rectangle.

Age 6

1. Distinguishes between morning and afternoon.
2. Defines familiar words in terms of use.
3. Copies a diamond.
4. Counts thirteen pennies.
5. Distinguishes pictures of ugly and pretty faces.

Age 7

1. Shows right hand and left ear.
2. Describes a picture.
3. Executes three commissions, given simultaneously.
4. Counts value of six sous, three of which are double.
5. Names four cardinal colours.

Age 8

1. Compares two objects from memory.
2. Counts from 20 to 0.
3. Notes omissions from pictures.
4. Gives day and date.
5. Repeats five digits.

Age 9

1. Gives change from 20 sous.
2. Defines familiar words in terms superior to use.
3. Recognizes all the pieces of money.
4. Names the months of the year in order.
5. Answers easy comprehension questions.

Age 10

1. Arranges five blocks in order of weight.
2. Copies drawing from memory.
3. Criticizes absurd statements.
4. Answers difficult comprehension questions.
5. Uses three given words in not more than two sentences.

Age 12

1. Resists suggestion.
2. Composes one sentence containing three given words.
3. Names 60 words in 3 minutes.
4. Defines certain abstract words.
5. Discovers the sense of a disarranged sentence.

Age 15

1. Repeats seven digits.
2. Finds three rhymes for a given word.
3. Repeats a sentence of 26 syllables.
4. Interprets pictures.
5. Interprets given facts.

Adult

1. Solves the paper-cutting test.
2. Rearranges a triangle in imagination.
3. Gives differences between pairs of abstract terms.
4. Gives three differences between a president and a king.
5. Gives the main thought of a selection which he has heard read.

The Stanford Revision. Professor Terman of Stanford University gave a thorough trial to these tests and rearranged them according to his own statistics in the year 1916. He changed Binet's procedure in some cases and split up some of the tests and regrouped the sub-tests, particularly the comprehension

tests. He also added a few new tests. The following is Terman's complete scale:

Age 3: (6 tests, 2 months each)

1. Points to parts of body. (3 of 4.) Nose; eyes; mouth; hair.
   Names familiar objects. (3 of 5.) Key; penny; closed knife; watch; pencil.
3. Pictures-enumeration or better. (At least 3 objects enumerated in one picture). Dutch home; river scene; post office.
4. Gives sex.
5. Gives last name.
6. Repeats 6 to 7 syllables. (1 of 3.)

Alternative. Repeats 3 digits. (1 success in 3 trials. Order correct).

Age 4: (6 tests, 2 months each)

1. Compares lines. (3 trials, no errors.)
2. Discrimination of forms (Kuhlman). (Not over three errors.)
3. Counts 4 pennies. (No error.)
4. Copies square. (Pencil, 1 of 3.)
5. Comprehension, first degree. (2 of 3.) (Stanford addition.)
6. Repeats 4 digits. (1 of 3. Order correct.) (Stanford addition.)

Alternative. Repeats 12 to 13 syllables. (1 of 3 absolutely correct, or 2 with one error each.)

Age 5: (6 tests, 2 months each)

1. Comparison of weights. (2 of 3.) 3-15; 15-3; 3-15.
2. Colours. (No error.) Red; yellow; blue; green.
3. Aesthetic comparison. (No error.)
4. Definitions, use or better. (4 of 6.)
5. Patience, or divided rectangle. (2 of 3 trials. 1 minute each.)
6. Three commissions. (No error. Order correct.)

Alternative. Giving age.

Age 6: (6 tests, 2 months each)

1. Right and left. (No error.) Right hand; left ear; right eye.
2. Mutilated pictures. (3 of 4 correct.)

3. Counts 13 pennies. (1 of 3 trials, without error.)
4. Comprehension, second degree. (2 of 3.)
5. Coins. (3 of 4.) Nickel; penny; quarter; dime.
6. Repeats 16 to 18 syllables. (1 of 3 absolutely correct, or 2 with 1 error each.)

Alternative. Morning or afternoon.

Age 7: (6 tests, 2 months each)

1. Fingers. (No error.) Right; left; both.
2. Pictures, description or better. (Over half of performance description.) Dutch home; river scene; post office.
3. Repeats 5 digits. (1 of 3. Order correct.)
4. Ties bow-knot. (Model shown. 1 minute.) (Stanford addition.)
5. Gives difference. (2 of 3.) Fly and butterfly; stone and egg; wood and glass.
6. Copies diamond. (Pen, 2 of 3.)

Alternative 1. Names days of week. (Order correct. 2 of 3 checks correct.)
2. Repeats 3 digits backwards. (1 of 3.)

Age 8: (6 tests, 2 months each)

1. Ball and field. (Inferior plan or better.) (Stanford addition.)
2. Counts 20 to 1. (40 seconds. One error allowed.)
3. Comprehension, third degree. (2 of 3.)
4. Gives similarities, 2 things. (2 of 4.) (Stanford addition.) Wood and coal; apple and peach; iron and silver; ship and automobile.
5. Definitions superior to use. (2 of 4.) Balloon; tiger; football; soldier.
6. Vocabulary, 20 words. (Stanford addition.)

Alternative. 1. First six coins. (No error.)
2. Dictation. ('See the little boy.' Easily legible. Pen, 1 minute.)

Age 9: (6 tests, 2 months each)

1. Date. (Allow error of 3 days in *c*, no error in *a*, *b*, or *d*.) (*a*) Day of week; (*b*) month; (*c*) day of month; (*d*) year.

2. Weights. (Procedure not illustrated. 2 of 3. 3, 6, 9, 12, 15.)
3. Makes change. (2 of 3. No coins, paper or pencil.) 10-4; 15-12; 25-4.
4. Repeats 4 digits backwards. (1 of 3.) (Stanford addition.)
5. Three words. (2 of 3. Oral. One sentence or not over 2 co-ordinate clauses.) Boy; river, ball; work, money, men; desert, rivers, lakes.
6. Rhymes. (3 rhymes for two of three words. One minute for each part.) Day; mill; spring.

Alternative 1. Months. (15 seconds and 1 error in naming. 2 checks of 3 correct.)
2. Stamps, gives total value. (Second trial if individual values are known.)

lge 10 · (6 tests, 2 months each)

1. Vocabulary, 30 words. (Stanford addition.)
2. Absurdities. (4 of 5. Warn. Spontaneous correction allowed.) (Four of Binet's, one Stanford.)
3. Designs. (1 correct, 1 half-correct. Expose 10 seconds.)
4. Reading and report. (8 memories. 35 seconds and 2 mistakes in reading.) (Binet's selection.)
5. Comprehension, fourth degree. (2 of 3. Question may be repeated.)
   (*a*) 'What ought you to say when someone asks your opinion about a person you don't know very well?'
   (*b*) 'What ought you to do before undertaking (beginning) something very important?'
   (*c*) 'Why should we judge a person more by his actions than by his words?'
6. Names 60 words. (Illustrate with clouds, dog, chair, happy.)

Alternative 1. Repeats 6 digits. (1 of 2. Order correct.) (Stanford addition.)
2. Repeats 20 to 22 syllables. (1 of 3 correct, or 2 with 1 error each.)
3. Form board. (Healy-Fernald Puzzle A. Three times in 5 minutes.)

Age 12: (8 tests, 3 months each)

1. Vocabulary, 40 words. (Stanford addition.)
2. Abstract words. (3 of 5.) Pity; revenge; charity; envy; justice.
3. Ball and field. (Superior plan.) (Stanford addition.)
4. Dissected sentences. (2 of 3. 1 minute each.)
5. Fables. (Score 4; i.e., two correct or the equivalent in half credits.) (Stanford addition.) Hercules and wagoner; maid and eggs; fox and crow; farmer and stork; miller, son and donkey.
6. Repeats 5 digits backwards. (1 of 3.) (Stanford addition.)
7. Pictures, interpretation. (3 of 4. 'Explain this picture.') Dutch home; river scene; post office; colonial home.
8. Gives similarities, three things. (3 of 5.) (Stanford addition.) Snake, cow, sparrow; book, teacher, newspaper; wool, cotton, leather; knife-blade, penny, piece of wire; rose, potato, tree.

Age 14: (6 tests, 4 months each)

1. Vocabulary, 50 words. (Stanford addition.)
2. Induction test. (Gets rule by sixth folding.) (Stanford addition.)
3. President and king. (Power; accession; tenure. 2 of 3.)
4. Problems of fact. (2 of 3.) (Binet's two and one Stanford addition.)
5. Arithmetical reasoning. (1 minute each. 2 of 3.) (Adapted from Bonser.)
6. Clock. (2 of 3. Error must not exceed 3 or 4 minutes.) 6-22, 8-10, 2-46.

Alternative. Repeats 7 digits (1 of 2. Order correct.)

Average Adult: (6 tests, 5 months each)

1. Vocabulary, 65 words. (Stanford addition.)
2. Interpretation of fables. (Score 8.) (Stanford addition.)
3. Difference between abstract words. (3 real contrasts out of 4.) Laziness and idleness; evolution and revolution; poverty and misery; character and reputation.
4. Problem of the enclosed boxes. (3 of 4.) (Stanford addition.)
5. Repeats 6 digits backwards. (1 of 3.) (Stanford addition.)

6. Code, writes 'Come quickly'. (2 errors. Omission of dot counts half error. Illustrate with 'war' and 'spy'.) (From Healy and Fernald.)

Alternative 1. Repeats 28 syllables. (1 of 2 absolutely correct.)

2. Comprehension of physical relations. (2 of 3.) (Stanford addition.) Path of cannon ball; weight of fish in water; hitting distant mark.

Superior Adult: (6 tests, 6 months each)

1. Vocabulary, 75 words. (Stanford addition.)
2. Binet's paper-cutting test. (Draws folds, and locates holes.)
3. Repeats 8 digits. (1 of 3. Order correct.) (Stanford addition.)
4. Repeats thought of passage heard. (1 of 2.) (Binet's and Wissler's selections adapted.)
5. Repeats 7 digits backwards. (1 of 3.) (Stanford addition.)
6. Ingenuity test. (2 of 3. 5 minutes each.) (Stanford addition.)

How the Stanford Revision was Carried Out. The revision is based on the results of applying the tests in 1913-14 to 982 children between the ages of 4 and 17. The testing of children was done by six examiners and the work of assessing was all done by Professor Terman. The data for the tests of adults were obtained from the results of testing 40 high school pupils, 30 businessmen, 15 migrating unemployed and 150 juvenile delinquents all done by different examiners. The several stages in the investigation can best be given in the words of the authors.[1]

'1. We first assembled as nearly as possible all the results which had been secured for each test of the Binet scale by all the workers of all countries, including percentages passing the test at various ages, conditions under which the results were secured, method of procedure, etc. After a comparative study of these data, and in the light of results we had ourselves secured, a provisional arrangement of the tests was prepared for trial.

[1] *The Stanford Revision and Extension of the Binet-Simon Scale for Measuring Intelligence* (Warwick and York, 1917).

'2. A plan was then devised for securing subjects who should be as nearly as possible representative of the several ages. The method was to select a school in a community of average social status, a school attended by all, or practically all, the children in the district where it was located. In order to get clear pictures of age differences, the tests were confined to children who were within two months of a birthday. . . .

'3. The children's responses were for the most part recorded verbatim. This made it possible to re-score the records according to any desired standard and thus fit a test more perfectly to the age level assigned it.

'4. The tests were made at an average rate of about 50 minutes per test. The time was rarely below 40 minutes, except with the children of four and five years. The older children and adults more often required from 50 minutes to an hour. . . .

'5. As may be inferred from the time required, the testing was reasonably thorough. It is possible, however, that occasionally a success has been missed by not carrying the test high enough, or a failure missed by not going back far enough. Errors of this sort doubtless about balance in the long run. . . .

'6. Much attention was given to securing uniformity of procedure. A half-year was devoted to training the examiners and another half-year to the supervision of the testing. In the further interests of uniformity all the records were scored by one person (Terman).'

After the records of testing were complete the tests were to be allocated to the proper ages on the basis of these records. In this connexion the authors say: 'As was to be expected, the first draft of the revision did not prove satisfactory. The scale was still too hard at some points and too easy at others. Three successive revisions were necessary, involving three separate scorings of the data and as many tabulations of the mental ages, before the desired degree of accuracy was secured. As finally left, the scale gives a median intelligence quotient closely approximating 100 for our non-selected children of each age.'

Some Flaws in the Stanford Investigation. The Stanford investigation was carried out with very great care and the efforts made to improve upon the original Binet-Simon scale were commendable. Still certain drawbacks remained in the

experiment.[1] In the first place, one would have wished that all the children from the most representative groups had been examined instead of children only within 2 months of a particular age. Thus children of 8 years in the investigation are children between 7 years 10 months and 8 years 2 months, those of 9 years are between 8 years 10 months and 9 years 2 months, and so on. Secondly, there are only 17 children in the fourth year group, i.e., presumably these children are between 3 years 10 months and 4 years 2 months, while one would wish to have about 50 children in each age-group. Thirdly, there are no children, it would appear, below 3 years 10 months, while it was desirable to have at least 50 children more below this level. Fourthly, in the same way there are only 14 children between 16 and 17 years; thus the scale does not seem to have been properly tried for children above the 15-year level. Lastly, it appears that both in this as well as in Burt's London investigation the children of special schools for the mentally backward children are not taken into account. The highly developed educational organizations of the large cities in America and England had already separated out the mentally backward children and sent them into special schools. Thus it was impossible to take into account these children in an ordinary investigation. If on the contrary all such children were taken into account the number of such children would be far in excess of the number that would be justifiable from the total number of children investigated in the experiment. At the same time since children of exceptional ability are not usually separated but attend the ordinary schools they are naturally included in the investigation. This seems to mean that while exceptionally intelligent children are included in the population of children tested, exceptionally backward children are excluded. This would naturally raise the percentage of children passing the test in the several age-groups. In other words the scale as a whole would be slightly more difficult than it ought to be if the general population of absolutely unselected children were examined.

The New Stanford Revision. Terman and Merrill brought out a new revision of the Binet Scale in 1937, under the

[1] Since writing this we are glad to note that Terman and Merrill have brought out a new revision, *Measuring Intelligence* (Harrap, 1937), which removes the flaws mentioned here.

name, *Measuring Intelligence*, published by George G. Harrap and Co. This revision is in two parallel forms, L and M. This is statistically a better standardized revision than the old one. About the old standardization of 1916 the authors themselves say: 'Although affording a satisfactorily valid and reliable measure over a fairly wide intermediate range, it was especially defective at both extremes. Abilities below the level of four years or above that of the average adult were very inadequately sampled. In the range from five to ten years the standardization was surprisingly correct, considering the rather small number of subjects on which it was based, but above ten it yielded scores that were progressively too low.' The great advantage of the new revision is that there are two parallel forms, which afford facilities for retesting, as well as to check the effect of coaching. The new test, however, seems to be more urbanized and the simplicity and generality of the original Binet test are lost. As a result city children are expected to give unduly higher scores compared with rural children. The scales are much less suited to Indian conditions, where the urbanized forms of the stove, the bed, the dustpan, the fork and such other things are much less familiar to our children. For use in India the forms will have to be restandardized, changing much of the material used, and probably out of all recognition.

CHAPTER V

THE BOMBAY-KARNATAK REVISION[1]

INTELLIGENCE Testing in India. Though intelligence testing after Binet has been in use for more than two decades in western countries, it is regrettable that until now very little work in this field has been done in India. These mental tests to be of any great value must be rendered into the languages of the different states of India. But the multiplicity of these languages in India need not be any great hindrance in the way of the development of tests, because each region covered by the major languages of India will be as large as a country in Europe.

The only study worth the name undertaken in this country is that of Professor C. Herbert Rice of Lahore, who has worked in Hindustani and has adapted the Binet scale into a point scale. His work is embodied in the book, *A Hindustani Binet Performance Scale.*[2] As Professor Rice himself says, 'In the standardizing of these tests, 1,070 boys, varying in age from 5 to 16, all attending school, were examined.' This is, however, not a very comprehensive scale as it is only a point, and not an age, scale. Secondly, the children tested by him were all above 5 years of age, and ages below this level, which are psychologically the most important, were left untouched. Lastly, all the children tested by him were boys and none of them girls.

The Present Revision. This state of affairs led the writer to undertake a proper revision of Binet's scale to suit Indian conditions. For this purpose the Stanford revision of the scale was selected and closely followed. The town selected for the experiment was Dharwar in the old Bombay Presidency. This is a middle-sized town with, at that time, a population of a little over 30,000. The children of this town were expected to be neither very advanced like those of busy cities like Bombay,

[1] A brief account of this appeared in the *British Journal of Educational Psychology*, November 1934, and in *Teaching*, 1934 and 1936, published by the Oxford University Press, Bombay.

[2] Published by the Oxford University Press, Bombay, but now out of print.

nor very backward like those of remote villages. The children tested in this experiment therefore are fairly representative of the general population of Indian children. The tests were first of all translated into the two languages—Kannada and Marathi[1]. These languages between them cater to the needs of nearly all the State of Bombay and a large part of Mysore State. Some of the tests and material of the scale were unsuitable for Indian children and had to be replaced, and some had to be amended to suit Indian conditions. Thus Indian coins are substituted for American coins; the pictures required for the 'æsthetic comparison' and 'missing features' tests are given an Indian appearance, while retaining the original Binet features; pictures representing Indian life are substituted for pictures of western life in the 'description of pictures' test; the slip-knot is substituted for the bow-knot; the vocabulary tests are made up from the words in Kannada and Marathi dictionaries; in the tests of repeating syllables the original passages are translated into Indian languages retaining the original meaning and difficulty and containing the same number of syllables; in the test of 'finding rhymes' the Indian words selected are very similar to the original in sound, a conjunct consonant being substituted for a conjunct consonant and a nasal for a nasal; in the words for 'definitions and differences of abstract terms', words having the original sense are selected as far as possible, but in some cases the negative terms are used for the positive when the positive terms were found to be ambiguous or were used in more than one sense in the Indian languages; in the 'dissected sentences', the number of words in the Indian languages is kept the same as in the original as far as possible, and the sentences are dissected in the same way; in the 'reversing hands of clock' test, 11-10 is substituted for 8-10, as the latter was found to be rather ambiguous; the test 'giving differences between a patil and a kulkarni (village headman and village accountant)' is substituted for the test 'differences between a president and a king'; an entirely new Indian code is substituted for the English code (the characters in the Indian script are written altogether in a different style from the English script); a new form of Binet's 'reversing triangle in imagination' is added.

[1] A further revision of this scale in Gujarati is now available as prepared by N. N. Shukla and is published by Macmillan and Company, Bombay.

Some of the tests that were not timed either by Binet or Terman are carefully timed in this revision. This makes the tests more accurate; besides, if they are not so timed the examiner is at a loss to know when exactly to stop and proceed to the next test. This is a very great practical difficulty. A large number of children give an appearance of trying to solve the question and take too long over it and sometimes the answer is not forthcoming at all.

Age Assignment of the Tests. In allocating the tests to the proper ages the method advocated by Professor Cyril Burt is followed as that appeared to be more scientific than that of Professor Terman. Terman selects children within two months of an age and requires 66 per cent of the children of that age to pass the test before allocating it to that age. Professor Cyril Burt however requires 50 per cent of all the children who have just passed their last birthday and have not reached their next before allocating it to the latter age; that is, if a test is passed by 50 per cent of all the children between 6 and 7 years of age, the test is located in year VII.[1] Both methods in practice amount to the same thing, but the latter method has the advantage of not leaving out any children of a particular group of the general population, as for example, the children of a particular locality or school. In practice, even the method of Burt cannot be literally followed, for the simple reason that a test of a particular age-group, say the seventh, is not to be used for children of that age-group only, but for all children close to this age-group on both sides. When we consider the percentages of passes on both sides of this age-group we find very wide differences. In fact, the scale is to be regarded as a continuous scale and the average percentage of passes for the entire range or at least for a range of one or two years on both sides of the age-group should be ascertained. Thus now and then a test is passed by only about 20 per cent of the age-group to which it is assigned, but in the next group it may be passed by 70 per cent or 80 per cent. It is thus the average percentage rather than the percentage of any one year that is to be taken into account. Burt's contention assumes that there is mathematical uniformity in the percentage of passes. The following would be such a typical case:

[1] By common convention Arabic figures are used for chronological age and Roman figures for mental age.

Test of Year VII

Chronological age	4	5	6	7	8	9	10
Per cent passing	0	20	40	50	60	80	100

Such is however very rarely the case. The method followed in the present revision is to take the average percentage of the year of test, the year previous and the year following. This average percentage is 42. This procedure is further checked by arranging the several tests in the scale in such a manner that the percentages of passes for children of any one age-group, say the tenth year, broadly go on decreasing as we ascend the entire scale.

The following table shows the percentages

No. of Test	Name of Test	Age last birthday / Age next birthday	2 / 3	3 / 4	4 / 5
	YEAR III				
1.	Pointing to parts of body		100	100	100
2.	Naming familiar objects		57.1	97.5	100
3.	Repeating 2 digits		69.2	88.9	100
4.	Enumeration of objects in a picture		40	77.5	97.5
5.	Repeating 6 to 7 syllables		35.3	92.5	94.9
6.	Comparison of lines		38.7	89.7	97.4
Alt. 1.	Giving sex		24	79.5	100
Alt. 2.	Giving proper name		57	94.0	100
	YEAR IV				
1.	Repeating 3 digits		21.2	71.8	97.1
2.	Discrimination of forms		9.7	64.1	97.5
3.	Comprehension, first degree		12.9	64.1	82.9
4.	Repeating 12 to 13 syllables		0	31	70
5.	Counting 4 pice		0	12.8	60
6.	Copying a square		0	5.1	70.7
Alt.	Comparison of 2 weights		0	17.5	64.9
	YEAR V				
1.	Aesthetic comparison		0	17.5	30
2.	Definitions in terms of use		0	17.5	47.5
3.	Three commissions		0	17.5	47.5
4.	Distinguishing right and left		0	7.5	45
5.	Naming 4 coins		0	2.5	32.5
6.	Counting 13 pice		0	0	16.5
Alt. 1.	Forenoon and afternoon		0	5	36
Alt. 2.	Giving family name		14.3	25	50
Alt. 3.	Giving age		0	18.8	48.3

of passes for the several tests.

5	6	7	8	9	10	12	14	16
6	7	8	9	10	12	14	16	Above 16
100	100	100	100	100	100			
100	100	100	100	100	100			
100	100	100	100	100	100			
100	100	100	100	100	100			
100	100	100	100	100	100			
100	100	100	100	100	100			
100	100	100	100	100	100			
100	100	100	100	100	100			
96.2	100	100	100	100	100			
100	98.4	98.9	100	100	100			
93.8	98.4	100	100	100	100			
85.4	96.5	97.5	100	100	100			
95.2	98.4	100	100	100	100			
85.7	98.4	100	100	100	100			
89.7	98.4	99	100	100	100			
73.4	85.7	97.8	100	100	100	100	100	100
80	92.1	96.8	100	98.7	99	100	100	100
73.5	91.8	95.7	100	100	99.5	100	100	100
67.7	76.4	91.4	98.8	100	100	100	100	100
61.9	92.1	96.8	100	100	100	100	100	100
64.5	89.1	96.8	100	100	100	100	100	100
60	84.8	94.8	97.4	100	100	100	100	100
86.2	98.3	98.8	100	100	100	100	100	100
62.8	83.3	86	98.7	97.4	99.5	100	100	100

No. of Test	Name of Test	Age last birthday / Age next birthday	2 / 3	3 / 4	4 / 5
	YEAR VI				
1.	Repeating 4 digits		0	7.7	22
2.	Comprehension, second degree		0	7.5	30
3.	Divided card		0	5	27.5
4.	Giving number of fingers		0	0	12.5
5.	Description of pictures		0	0	7.5
6.	Missing features		0	0	20
Alt.	Naming colours		0	7.5	17.5
	YEAR VII				
1.	Repeating 16 to 18 syllables		0	2.5	25
2.	Copying a diamond		0	0	2.5
3.	Repeating 3 digits reversed		0	0	0
4.	Naming days of week		0	0	5.6
5.	Counting backwards 20 to 1		0	0	5.4
6.	Giving differences from memory		0	0	2.5
Alt.	Giving day of week and day of month		0	0	0
	YEAR VIII				
1.	Finding value of coins		0	0	0
2.	Repeating 5 digits		0	0	12.5
3.	Comprehension, third degree		0	0	2.7
4.	Definitions, superior to use		0	0	0
5.	Naming 6 coins		0	0	0
6.	Reading and report. (2 facts: 10 errors: 2 minutes.)				
Alt. 1.	Tying a slip-knot		0	0	7.9
Alt. 2.	Ball and field		0	0	0

5	6	7	8	9	10	12	14	16
6	7	8	9	10	12	14	16	Above 16
47.6	73	85.1	100	100	100	100	100	100
49.2	65.6	69 .6	92.6	90	98	100	100	100
45.3	65.1	86.8	98.7	98.7	99.5	100	100	100
46.9	71.9	89.5	98.7	100	100	100	100	100
40.6	63.9	60.2	94.9	88.9	95.9	100	100	100
33.3	50.8	64.5	88.7	91.4	98	100	100	100
40.6	49.2	77.2	97.5	96.2	99	100	100	100
38.1	50	64.5	85	89	96.4	100	100	100
20	45	66.3	78.7	95	95.8	100	100	100
17.4	42.4	60.8	88.3	93.8	97.1	99.4	100	100
4.7	40.4	53.4	84.7	86.9	95.7	98.2	100	100
13.1	35.9	50	84.8	84.8	94	100	100	100
9.4	33.3	44.6	72.2	78.7	92.2	99.4	100	100
6.2	29.2	39.1	81.1	76.3	91.5	98.1	100	100
4.3	13.6	50.7	78	87.7	95.3	100	100	100
14.1	29.7	41.5	70.4	81.3	90.2	99.4	100	100
9.7	25.4	44.1	73.7	76.9	86.3	97.6	100	100
9.9	17.5	41	66.2	77.4	84.9	97	100	100
5.2	11.3	35.1	60	86.1	93.4	98.8	100	100
	13.3	40	89.1	95				
14.1	27.4	50.6	64.9	81.3	90.3	97	100	100
3.8	13.2	41	65.4	78.3	92.6	99.3	100	100

No. of Test	Name of Test	Age last birthday / Age next birthday	2 / 3	3 / 4	4 / 5
	YEAR IX				
1.	Repeating 4 digits reversed		o	o	o
2.	Making change		o	o	o
3.	Giving similarities—2 things		o	o	o
4.	Using 3 words in a sentence		o	o	o
5.	Reading and report. (6 facts: 5 errors: 1 minute.)				
6.	Free association, 35 words in 3 minutes		o	o	o
Alt.	Vocabulary, 20 words		o	o	o
	YEAR X				
1.	Arranging 5 weights		o	o	o
2.	Repeating 20 to 22 syllables		o	o	o
3.	Naming the months		o	o	o
4.	Drawing designs from memory		o	o	o
5.	Finding rhymes		o	o	o
6.	Reading and report. (8 facts: 2 errors: 40 seconds.)		o	o	o
Alt. 1.	Vocabulary, 25 words		o	o	o
Alt. 2.	Giving month and year		o	o	o
	YEAR XII				
1.	Detecting absurdities		o	o	o
2.	Construction puzzle		o	o	o
3.	Defining abstract words		o	o	o
4.	Repeating 5 digits reversed		o	o	o
5.	Interpretation of fables (4 marks)		o	o	o
6.	Interpretation of pictures		o	o	o

[1] Only Kannada vocabulary.

5	6	7	8	9	10	12	14	16
6	7	8	9	10	12	14	16	Above 16
4.9	15.6	31.9	61.3	71.6	78.7	92.6	95.2	99
3.3	9.4	28.7	57.5	71.6	87.3	95.7	99	99
3.3	14.1	19.4	36.8	58.4	75	95.2	100	100
1.6	1.6	12.8	44.3	50	69.4	92.6	93.2	100
	3.2	9.6	38.8	59.5	77.4	89.5	93.5	97
0	6	15.6	44.8	35.5	61.5	76.2	87.5	88.1
0	0	15.2	50	69.6	95.4	100	100	100[1]
6.7	8.1	17.6	34.7	49.3	63	85.6	93	100
0	3.3	6.4	28.1	46.7	69.4	91.3	95	98.4
0	7.1	12.5	31.9	41.4	67.1	88.8	96.1	100
3.3	4.7	8.7	22.5	31.6	65.5	83.4	92.1	92.6
1.6	1.6	7.3	23.3	26 9	52.1	77.7	93.2	94.8
0	1.6	2.1	17.3	36.7	53.8	72.1	87	88.9
0	0	7.1	36.4	54.8	75 .8	90.2	97.2	100[1]
0	4.3	15.7	29.3	43	62.6	84.5	97.3	99
0	0	1.1	16	24.7	39.3	73.7	82	96
0	0	1.3	12	11.1	38.4	79.1	85.4	96.5
0	0	0	9.9	11.1	39	68.6	80.7	91.9
0	0	0	14.8	24.7	42.3	68.6	76.8	80.8
0	0	0	4.9	16.3	35.1	70.1	86.4	94
0	0	0	6.2	10.1	29.2	61.9	79.1	85.8

No. of Test	Name of Test	Age last birthday / Age next birthday	2 / 3	3 / 4	4 / 5
	YEAR XII—*contd.*				
Alt. 1.	Vocabulary, 30 words		0	0	0
Alt. 2.	Repeating 6 digits		0	0	0
Alt. 3.	Comprehension, fourth degree		0	0	0
	YEAR XIV				
1.	Induction test: Finding a rule		0	0	0
2.	Dissected sentences		0	0	0
3.	Arithmetical reasoning		0	0	0
4.	Problems of enclosed boxes		0	0	0
5.	Giving similarities —3 things		0	0	0
6.	Ball and field, superior plan		0	0	0
Alt.	Vocabulary, 40 words		0	0	0
	YEAR XVI (Adult)				
1.	Interpretation of fables (8 marks)		0	0	0
2.	Reversing hands of clock		0	0	0
3.	Giving differences, Patil and Kulkarni		0	0	0
4.	Repeating 6 digits reversed		0	0	0
5.	Problem questions		0	0	0
6.	Repeating 7 digits		0	0	0
Alt. 1.	Vocabulary, 45 words		0	0	0
Alt. 2.	Free association, 60 words in 3 minutes		0	0	0
	YEAR XIX (Superior Adult)				
1.	Using a code		0	0	0
2.	Ingenuity test		0	0	0
3.	Differences between abstract terms		0	0	0
4.	Binet's paper-cutting test		0	0	0
5.	Repeating 30 syllables		0	0	0
6.	Reversing triangle in imagination (new form)		0	0	0
Alt.	Vocabulary, 55 words		0	0	0

Only Kannada vocabulary.

5	6	7	8	9	10	12	14	16
6	7	8	9	10	12	14	16	Above 16
0	0	7.1	22.7	25.8	45.6	76.5	94.4	100[1]
0	0	2.2	10.2	20.8	42.3	72	85.7	92.3
0	0	1.1	10.5	17.5	30.5	57.8	80.6	95.9
0	0	0	7.4	14.8	32.1	63.2	67.6	74.5
0	0	0	3.1	10.1	24.9	56.6	75.6	84.7
0	0	0	1.2	9.9	24.5	47.6	61.1	71.4
0	0	0	2.6	3.7	19.4	53	56.5	64.6
0	0	0	1.3	5.3	14.5	38.4	56	77.1
1.6	0	0	4.4	7.1	24.6	54.5	61.3	83
0	0	0	0	0	18.2	43.7	77.8	97.2[1]
0	0	0	1.3	2.5	10.3	31.5	50	66
0	0	0	3.7	4.9	16.3	39.4	51.4	58.6
0	0	0	0	7.5	11.3	26.8	47.2	60
0	0	0	1.3	4.9	11.2	29.9	44.9	43.9
0	0	0	0	1.2	2.1	20.8	44.6	58.2
0	0	0	1.2	3.7	14.9	26.7	41.4	41.7
0	0	0	0	0	6.1	14.3	55.6	89.2[1]
1.6	0	1.1	2.6	9.3	18.4	32.3	34.9	42.4
0	0	0	1.3	1.2	5.2	16.1	36.5	39.8
0	0	0	0	0	5.1	14	32.5	36.2
0	0	0	0	0	3.6	14.1	26.4	41.4
0	0	0	0	0	4.1	12.1	27.8	32.3
0	0	0	0	5.1	4.2	13.7	25.5	30.5
0	0	0	0	0	0	8.3	26.7	28.1
0	0	0	0	0	1.5	2	16.7	24.3[1]

No. of Test	Name of Test	Age last birthday / Age next birthday	2 / 3	3 / 4	4 / 5

YEAR XXII (Very Superior Adult)

1.	Comprehension of physical relations ..	0	0	0
2.	Repeating 8 digits	0	0	0
3.	Repeating thought of passage heard ..	0	0	0
4.	Reversing triangle in imagination (Binet's form)	0	0	0
5.	Repeating 7 digits reversed	0	0	0
6.	Free association, 80 words in 3 minutes	0	0	0
Alt.	Vocabulary, 60 words	0	0	0

[1] Only Kannada vocabulary.

[2] The percentages of adults of over 16 years of age are less in these 4 tests than those of adolescents between 14 and 16 Is this due to the falling off of immediate memory? The point deserves to be further investigated.

5	6	7	8	9	10	12	14	16
6	7	8	9	10	12	14	16	Above 16
0	0	0	0	0	.7	4.2	6.8	9.5
0	0	0	0	1.3	2.6	6.7	13.3	7.2[2]
0	0	0	0	0	.5	6.1	15	13.3[2]
0	0	0	0	0	0	0	9.2	3.3[2]
0	0	0	0	1.3	2.6	7.3	10.8	8.2[2]
0	0	0	0	0	1.8	10.3	10.6	12.3
0	0	0	0	0	0	0	5.6	8.3[1]

The real criterion, however, of the accuracy of the scale is the coincidence of the mean mental age and the mean chronological age of every age-group of the scale; or, what comes to the same thing, the mean I.Q. of every age-group in the different parts of the scale coming as close as possible to 100. After the sequence of the tests was fixed according to the percentage of passes as shown above and a tentative age scale on the 50 per cent basis as recommended by Burt obtained, the I.Q.s of all children were determined and the mean I.Q. for every age-group calculated as also the mean I.Q. for the entire population of children tested. This mean I.Q. ought to be 100. It was found, however, that it was somewhat below 100. The entire scale therefore was pushed upwards by a few steps. Even now the new calculations did not yield a mean I.Q. of 100. The scale was again shifted a bit and a third calculation was obtained which gave a mean I.Q. close upon 100. The following table gives the mean I.Q. and the standard deviation of the different groups in the entire age range:

Chronological age	Mean I.Q.	Standard deviation	No. of children
2 to 3 years 11 months ...	104.8	15	75
4 to 5 years 11 months ...	99.1	17.1	104
6 to 7 years 11 months .	95.5	16	158
8 to 9 years 11 months ..	100.4	20.5	162
10 to 11 years 11 months ...	99.8	23	196
12 to 13 years 11 months ...	102.9	18.8	167
14 and above ..	98.8	15.2	212
For entire group . .	99 8	18.7	
Total number of children ...	...	...	1,074

It will be seen that the standard deviation of I.Q.s for the entire group is 18.7,[1] while Terman found it to be somewhere near 13 for his group. This means that the Indian children studied in the present experiment are scattered to the extent of nearly one-and-a-half times more widely about the mean than Terman's American children. Further the scatter of these children about the mean

[1] Corrected by Sheppard's formula it comes to 18.5.

is widest in the middle of the age range, that is between the years 8 and 12, and it becomes narrower both at the upper and the lower ends. Fig. 1 gives graphically the distribution of the I.Q.s of 1,074 children tested in the present study:

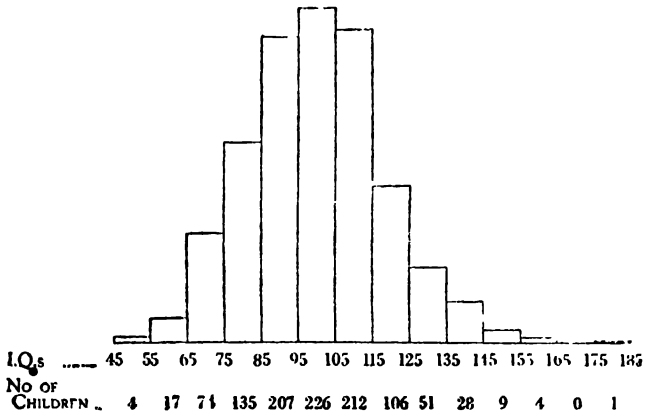


FIG. 1. Distribution of I.Q.s of 1,074 children of both sexes in the Bombay-Karnatak revision.

Fig. 2 gives the distribution of 745 children between 5 and 14 years of age, with Terman's distribution for the same group superposed in dotted lines for easy comparison.

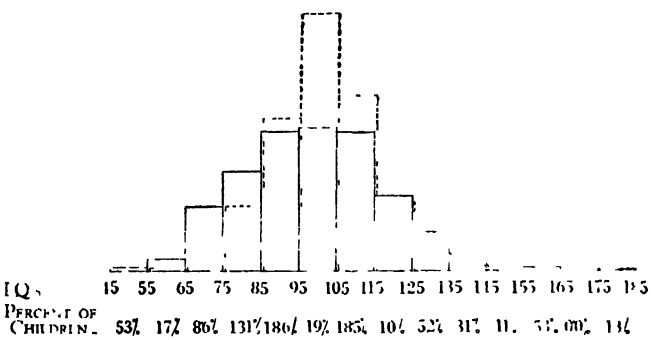


FIG. 2. Distribution of I.Q.s of 745 unselected children, 5-14 years of age Terman's corresponding distribution is superposed in dotted lines.

Fig. 3 is a similar histogram worked out for adults for comparison with Terman's. It will be seen that the range of distribution of I.Q.s in the latter group is very much narrower than the corresponding range in the present study. Thus it would appear that the highest I.Q. obtained by Terman in this group is less than 120 and the lowest a little above 80. The highest I.Q. possible for the same group in the present arrangement of the scale would be nearly 140 and the lowest a little below 60. The I.Q.s are thus distributed over equal distances on both sides of the mean. This is the justification for adding one more age-group, namely XXII, in the present revision. About 10 per cent of the adults pass the tests in this group.

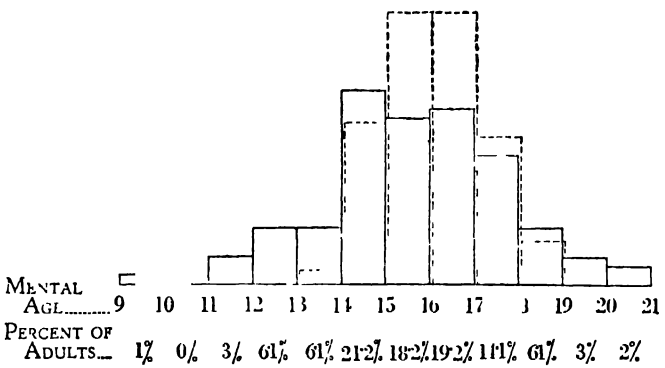


FIG. 3. Distribution of mental ages of 99 normal adults. Terman's corresponding distribution is superposed in dotted lines.

The following is the scale of tests arranged as a result of the present study. The table shows also the age-assignment by other workers for comparison. There are 13 age-groups as against 12 of Terman and 99 individual tests as against his 90. In using the scale it should be remembered that, as a rule, the same kind of test should not be used in more than one age-group for the same child. Thus the score of 'vocabulary' or 'free association' tests should be taken into account in one age-group only for any one child, the highest score being counted. The alternative tests are to be used only when the ordinary tests are for some reason unsuitable.

INTELLIGENCE TESTS FOR INDIAN CHILDREN

These tests are to be given in the mother-tongue. They are standardized from the results of 1,074 children examined individually. The Mean of the intelligence quotients of the children on this scale was 99.8 and the standard deviation 18.7.

No. of Test	Name of Test and Year	Age-assignment by previous workers				
		Binet 1911	Terman (Stanford revision)	Burt	Bobertag	Saffiotti
	YEAR III					
1.	Pointing to parts of body	III	III	III	...	...
2.	Naming objects ...	IV	III	III	...	...
3.	Repeating 2 digits ...	III	...	III	...	...
4.	Enumeration of pictures ...	III	III	III	...	...
5.	Repeating 6 to 7 syllables	III	III	IV	...	...
6.	Comparison of two lines ...	IV	IV	IV	...	...
Alt. 1.	Giving sex	IV	III	III	...	...
Alt. 2.	Giving proper name (Bombay-Karnatak addition)	...	...	...	...	...
	YEAR IV					
1.	Repeating 3 digits ...	IV	III	IV	...	...
2.	Discrimination of forms	...	IV	...	...	...
3.	Comprehension, first degree	...	IV	...	...	...
4.	Repeating 12 to 13 syllables	V (10 syll.)	IV	V (10 syll.)	V (10 syll.)	...
5.	Counting 4 pice ...	V	IV	IV	V	...
6.	Copying a square ...	V	IV	V		VI
Alt.	Comparison of 2 weights ...	V	V	V	V	V?
	YEAR V					
1.	Aesthetic comparison	VI	V	IV	VI	VI
2.	Definitions—use ...	VI	V	VI	V	VII

No. of Test	Name of Test and Year	Age-assignment by previous workers				
		Binet 1911	Terman (Stanford revision)	Burt	Bobertag	Saffiott
	YEAR V—*contd.*					
3.	Three commissions ...	VII	V	V	VI	VI
4.	Right and left ...	VII	VI	VI	VII	...
5.	Naming 4 coins ...	...	VI	VI	VII?	...
6.	Counting 13 pice ...	VI	VI	VI	VI	VIII
Alt. 1.	Forenoon and afternoon ...	VI	VI	V	VII	VI
Alt. 2.	Giving family name ...	III	III	III	...	...
Alt. 3.	Giving age ...	...	V	V	VI	...
	YEAR VI					
1.	Repeating 4 digits ...	...	IV	V	V	...
2.	Comprehension, second degree ...	...	VI	...	...	...
3.	Divided card ...	V	V	VI	VI	VIII
4.	Giving number of fingers ..	...	VII	VI	VII	..
5.	Description of pictures	VII	VII	VI	VII	...
6.	Missing features ...	VIII	VI	VII	VII	VIII
Alt.	Naming colours ...	VII	V	V	VIII	VIII
	YEAR VII					
1.	Repeating 16 to 18 syllables ...	...	VI	VI	VI	...
2.	Copying a diamond ...	VI	VII	VI	VII	VIII
3.	Repeating 3 digits reversed ...	...	VII	...	.	...
4.	Naming days of week	...	VII	VI	VIII	...
5.	Counting backwards 20 to 1 ...	VIII	VIII	VIII	VIII	VIII
6.	Giving differences from memory ...	VIII	VII	VII	VIII	VII
Alt.	Giving day of week and day of month (Bombay-Karnatak addition) ...	...	...	...	...	..

No. of Test	Name of Test and Year	Age-assignment by previous workers				
		Binet 1911	Terman (Stanford revision)	Burt	Bobertag	Saffiotti
	YEAR VIII					
1.	Finding value of coins	VII	...	VII	VII	X
2.	Repeating 5 digits ...	VIII	VII	VI	VII	VIII
3.	Comprehension, third degree ...	IX?	VIII	VIII?	VIII?	VIII?
4.	Definition, superior to use ..	IX?	VIII	IX?	IX?	...
5.	Naming 6 coins ...	IX?	VIII	IX?	X?	...
6.	Reading and report. (2 facts: 10 errors: 2 minutes) ...	...	...	VIII	IX?	...
Alt. 1.	Tying a slip-knot (Bombay-Karnatak addition) ...	...	...	...	...	...
Alt. 2.	Ball and field ...	...	VIII	...	...	...
	YEAR IX					
1.	Repeating 4 digits reversed ...	...	IX	...	...	...
2.	Making change ...	IX?	IX	VIII?	IX?	XI?
3.	Giving similarities—2 things ...	...	VIII	. .	...	...
4.	Using 3 words in a sentence ...	XII	IX	XI	XI-XII	. .
5.	Reading and report. (6 facts: 5 errors: 1 minute) ...	...	...	IX	X?	...
6.	Free association, 35 words in 3 minutes (Bombay-Karnatak addition) ...	...	...	...	...	...
Alt.	Vocabulary, 20 words	...	...	...	...	...
	YEAR X					
1.	Arranging 5 weights	X	IX	X	IX	VIII
2.	Repeating 20 to 22 syllables ...	...	X	...	...	...
3.	Naming the months . .	IX	IX	IX	X	IX

No. of Test	Name of Test and Year	Age-assignment by previous workers				
		Binet 1911	Terman (Stanford revision)	Burt	Bobertag	Saffiotti
	YEAR X—*contd.*					
4.	Drawing designs from memory ...	X	X	X	...	...
5.	Finding rhymes ...	XV	IX	XII	XI-XII	...
6.	Reading and report. (8 facts: 2 errors: 40 sec.) ...	...	X	...	...	...
Alt. 1.	Vocabulary, 25 words	...	...	...	..	...
Alt. 2.	Giving month and year	VIII	IX	VIII	IX	VIII
	YEAR XII					
1.	Detecting absurdities	X	X	XI	XI-XII	XI
2.	Construction puzzle ..	...	X	...	...	...
3.	Defining abstract words ...	XII?	XII	XIV?	XI-XII?	...
4.	Repeating 5 digits reversed .	...	XII	...	...	...
5.	Interpretation of fables (4 marks) ...	...	XII	...	...	...
6.	Interpretation of pictures ...	XV	XII	XII	...	...
Alt. 1.	Vocabulary, 30 words	...	...	..	...	...
Alt. 2.	Repeating 6 digits ...	...	X?	VIII	X	...
Alt. 3.	Comprehension, fourth degree ...	X	X	XI	XI-XII	XI?
	YEAR XIV					
1.	Induction test ...	...	XIV	...	..	...
2.	Dissected sentences ...	XII	XII	XII	XII	XIV
3.	Arithmetical reasoning	...	XIV	...	...	...
4.	Problems of enclosed boxes ...	...	XVI	...	...	...
5.	Giving similarities—3 things ...	...	XII	...	...	...

No. of Test	Name of Test and Year	Age-assignment by previous workers				
		Binet 1911	Terman (Stanford revision)	Burt	Bobertag	Saffiotti
	YEAR XIV—*contd.*					
6.	Ball and field, superior plan ...	...	XII	...	...	...
Alt.	Vocabulary, 40 words	...	...	...	...	...
	YEAR XVI (Adult)					
1.	Interpretation of fables (8 marks)	...	XVI	...	...	...
2.	Reversing hands of clock	...	XIV	...	...	...
3.	Giving differences, Patil and Kulkarni (Bombay-Karnatak addition) ...	Ad.?	XIV?	XVI?	...	...
4.	Repeating 6 digits reversed ...	...	XVI	...	...	...
5.	Problem questions ...	XV	XIV	XIII	...	...
6.	Repeating 7 digits ...	XV?	XIV	XI?	X	...
Alt. 1.	Vocabulary, 45 words	...	...	...	...	...
Alt. 2.	Free association, 60 words in 3 minutes	XII	X	XI	...	...
	YEAR XIX (Superior Adult)					
1.	Using a code (Bombay-Karnatak addition)	...	...	...	...	...
2.	Ingenuity test ...	...	XIX	...	...	...
3.	Differences between abstract terms ...	Ad.	XVI	XV	..	...
4.	Binet's paper-cutting test ...	Ad.	XIX	XV	...	...
5.	Repeating 30 syllables	XV (26 syll.)	XVI (28 syll.)	XIV (26 syll.)	X (26 syll.)	XII (26 syll.)
6.	Reversing triangle in imagination (new form) (Bombay-Karnatak addition) ...	...	...	...	...	...
Alt.	Vocabulary, 55 words	...	...	...	...	...

No. of Test	Name of Test and Year	Age-assignment by previous workers				
		Binet 1911	Terman (Stanford revision)	Burt	Bobertag	Saffiotti
	YEAR XXII (Very Superior Adult)					
1.	Comprehension of physical relations ...	...	XVI	...	...	...
2.	Repeating 8 digits ...	...	XIX	...	...	...
3.	Repeating thought of passage heard ...	Ad.	XIX?	XVI	...	...
4.	Reversing triangle in imagination (Binet's form) ...	Ad.	...	XV	...	...
5.	Repeating 7 digits reversed ...	...	XIX	...	...	...
6.	Free association, 80 words in 3 minutes (Bombay-Karnatak addition) ...	...	...	...	...	...
Alt.	Vocabulary, 60 words	...	...	...	...	...

N.B.—The sign (?) indicates that the results are not strictly comparable for some reason or other.

The Validity of the Tests. After the tests were allocated to the proper ages according to the percentages of passes the validity of each test was further examined as follows. A four-fold table was drawn up and the correlation of the pluses and minuses of each test with mental age, as determined by the scale as a whole, was found out. The correlation coefficients of the tests (in this case technically called the coefficients of association) were generally higher than 0.7, thus testifying to the validity of the tests. The coefficients of association of five of the tests, however, were a little less than 0.6. They are retained for want of more suitable tests. These tests are—V, Alt. 3, Giving Age, Q=0.56; VIII, Alt. 1, Tying a Slip-knot, Q=0.55; X, 1, Arranging 5 Weights, Q=0.57; XVI, 3, Giving Differences between Patil and Kulkarni, Q=0.58; XIX, 6, Reversing Triangle in Imagination (new form) Q=0.55.

The following is one of these four-fold tables:

IX, 4, Using 3 words in a sentence.

	Score	
	Minus	Plus
Mental age IX and above	62	255
Below IX	155	45

Coefficient of association, Q=0.87±0.018.[1]

Where the same test was used in more than one age-group a correlation table with a large number of chambers, for example five horizontal and five vertical, was drawn up and the correlation coefficients of the scores with mental ages were found out. The following table gives the coefficients of each of the tests with mental ages.

No. of Test	Name of Test and Year	Coefficient of Association with Mental Age
	YEAR III	
1.	Pointing to parts of body	1 (nearly)
2.	Naming objects	.68

[1] The formula (Yule's) used here is $Q = \frac{bc - ad}{bc + ad}$. If the formula $\omega = \frac{\sqrt{bc} - \sqrt{ad}}{\sqrt{bc} + \sqrt{ad}}$ is used the values are a little less The probable errors of the individual tests in the scale are not given. They are of the order .012 to .02 generally.

No. of Test	Name of Test and Year	Coefficient of Association with Mental Age
	YEAR III—*contd.*	
3.	Repeating 2 digits	.93[1]
4.	Enumeration of pictures	.96
5.	Repeating 6 to 7 syllables	.89[1]
6.	Comparison of two lines	.96
Alt. 1.	Giving sex	.95
Alt. 2.	Giving proper name	1 (nearly)
	YEAR IV	
1.	Repeating 3 digits	.93[1]
2.	Discrimination of forms	.98
3.	Comprehension, first degree	.93
4.	Repeating 12 to 13 syllables	.89[1]
5.	Counting 4 pice	.98
6.	Copying a square	.96
Alt.	Comparison of 2 weights	.84
	YEAR V	
1.	Aesthetic comparison	.87
2.	Definitions—use	.89
3.	Three commissions	.91
4.	Right and left	.88
5.	Naming 4 coins	.89
6.	Counting 13 pice	.98
Alt. 1.	Forenoon and afternoon	.8
Alt. 2.	Giving family name	.92
Alt. 3.	Giving age	.56
	YEAR VI	
1.	Repeating 4 digits	.93[1]
2.	Comprehension, second degree	.69
3.	Divided card	.85
4.	Giving number of fingers	.93
5.	Description of pictures	.64
6.	Missing features	.75
Alt.	Naming colours	.79
	YEAR VII	
1.	Repeating 16 to 18 syllables	.89[1]
2.	Copying a diamond	.87
3.	Repeating 3 digits reversed	.71

[1] Product moment r by diagonal adding.

No. of Test	Name of Test and Year	Coefficient of Association with Mental Age
	YEAR VII—*contd.*	
4.	Naming days of week	.86
5.	Counting backwards 20 to 1	.94
6.	Giving differences from memory	.79
Alt.	Giving day of week and day of month ...	.87
	YEAR VIII	
1.	Finding value of coins	.96
2.	Repeating 5 digits	.93[1]
3.	Comprehension, third degree	.78
4.	Definition, superior to use	.83
5.	Naming 6 coins	.9
6.	Reading and report. (2 facts: 10 errors: 2 minutes)	.9
Alt. 1.	Tying a slip-knot	.55
Alt. 2.	Ball and field	.71
	YEAR IX	
1.	Repeating 4 digits reversed	.7[1]
2.	Making change	.9
3.	Giving similarities—2 things	.84
4.	Using 3 words in a sentence	.87
5.	Reading and report. (6 facts: 5 errors: 1 minute)	.81
6.	Free association, 35 words in 3 minutes ...	.75
Alt.	Vocabulary, 20 words	.89[1]
	YEAR X	
1.	Arranging 5 weights	.57
2.	Repeating 20 to 22 syllables	.89[1]
3.	Naming the months	.84
4.	Drawing designs from memory	.78
5.	Finding rhymes	.78
6.	Reading and report. (8 facts: 2 errors: 40 sec.)	.83
Alt. 1.	Vocabulary, 25 words	.89[1]
Alt. 2.	Giving month and year	.91
	YEAR XII	
1.	Detecting absurdities	.89
2.	Construction puzzle	.85

[1] Product moment *r* by diagonal adding.

No. of Test	Name of Test and Year	Coefficient of Association with Mental Age
	YEAR XII—*contd.*	
3.	Defining abstract words	.88
4.	Repeating 5 digits reversed	.7[1]
5.	Interpretation of fables (4 marks)	.94
6.	Interpretation of pictures	.84
Alt. 1.	Vocabulary, 30 words	.89[1]
Alt. 2.	Repeating 6 digits	.93[1]
Alt. 3.	Comprehension, fourth degree	.85
	YEAR XIV	
1.	Induction test	.61
2.	Dissected sentences	.88
3.	Arithmetical reasoning	.77
4.	Problems of enclosed boxes	.74
5.	Giving similarities—3 things	.88
6.	Ball and field, superior plan	.66
Alt.	Vocabulary, 40 words	.89[1]
	YEAR XVI (Adult)	
1.	Interpretation of fables (8 marks)	.72
2.	Reversing hands of clock	.82
3.	Giving differences, Patil and Kulkarni ...	.58
4.	Repeating 6 digits reversed	.7[1]
5.	Problem questions	.8
6.	Repeating 7 digits	.93[1]
Alt. 1.	Vocabulary, 45 words	.89[1]
Alt. 2.	Free association, 60 words in 3 minutes ...	.64
	YEAR XIX (Superior Adult)	
1.	Using a code	.89
2.	Ingenuity test	.65
3.	Differences between abstract terms ...	.78
4.	Binet's paper-cutting test	.63
5.	Repeating 30 syllables	.89[1]
6.	Reversing triangle in imagination (new form)	.55
Alt.	Vocabulary, 55 words	.89[1]
	YEAR XXII (Very Superior Adult)	
1.	Comprehension of physical relations ..	.75
2.	Repeating 8 digits	.93[1]

[1] Product moment r by diagonal adding.

No. of Test	Name of Test and Year	Coefficient of Association with Mental Age
	YEAR XXII (Very Superior Adult)—*contd.*	
3.	Repeating thought of passage heard ...	.82
4.	Reversing triangle in imagination (Binet's form)	.83
5.	Repeating 7 digits reversed	.7[1]
6.	Free association, 80 words in 3 minutes ...	.79
Alt.	Vocabulary, 60 words	.89[1]

The Validity of the Scale as a Whole. The validity of the scale as a whole was further tested by correlating the I.Q.s as determined by the scale with the teachers' estimates of intelligence. If any scale of intelligence is to be regarded as valid it must correlate highly with outside reliable criteria of intelligence. Such a reliable criterion of intelligence in the case of school children is often taken to be the teachers' estimates. As teachers however judge the intelligence of children from the marks they score in the class or the ranks they secure as a result of these marks and as in their judgements teachers do not take into account the ages of children in their class, such of the children in each class as were of normal age for the class only were selected and they were then grouped into five classes as Very Inferior, Inferior, Average, Superior and Very Superior according to the estimates of their teachers. The I.Q.s were also grouped into five classes as follows: Below 70, 70 to 85, 86 to 115, 116 to 130, Above 130. Thus the correlation coefficient between the I.Q.s and the teachers' estimates was found. This was nearly 0.5, which is fairly high considering the variability of teachers' estimates[2] and shows how the scale as a whole agrees with the teachers' estimates.

[1] Product moment *r* by diagonal adding.

[2] In this calculation the estimates given by primary school teachers had to be neglected and only those of secondary school teachers taken, as it was found that primary school teachers, particularly in the lower classes, knew very little of the children under them. When all estimates were considered even irrespective of age the coefficient of correlation was 0.37. Other investigators also report a low correlation. C. Spearman, in *The Abilities of Man* (1927) p. 188, instances the work of Wilson, who found correlations between various group tests and teachers' estimates to lie between 0.30 and 0.40. On the whole there is no doubt that the scores from carefully standardized intelligence tests are a better measure of intelligence than the teachers' crude estimates. There is not much point, therefore, in determining the validity of tests from teachers' estimates altogether. See J. C. Flugel, *A Hundred Years of Psychology* (Duckworth, 1933), p. 307.

Classification of Children. The classification of children according to their chronological ages is given in the following table:

Age	No. of children	Age	No. of children	Age	No. of children
Yr. Y.M.		Yr. Y.M.		Yr. Y.M.	
Below 3	35	8 to 8-11	79	14 to 14-11	56
3 to 3-11	40	9 to 9-11	83	15 to 15-11	57
4 to 4-11	42	10 to 10-11	99	16 to 16-11	45
5 to 5-11	62	11 to 11-11	67	17 to 17-11	23
6 to 6-11	65	12 to 12-11	82	18 & above	31
7 to 7-11	93	13 to 13-11	85	TOTAL	1,047

According to caste they were divided into Advanced Hindus, Intermediate Hindus, Backward Hindus, Mohammedans and Christians. The following table shows this classification:

Name of group	Castes included in the group		No of children
Advanced Hindus ...	Brahmins ...		653
Intermediate Hindus ...	Marathas ...	64	
	Lingayats ...	129	
	Other Intermediate Hindus ...	140	
			333
Backward Hindus ...	Mahars, Chambars, etc.		17
Mohammedans ...	...		39
Christians ...	...		3
	TOTAL		1,074

For correlations with I.Q.s and other statistical purposes Mohammedans and Christians are included in the Intermediate Class of social status.

Lastly as classified by standards they are as follows:

Standard	No. of Children
Pre-school	118
Primary—Infants' class	149
,, First Standard	71
,, Second Standard	98
,, Third Standard	93
,, Fourth Standard	112
,, Fifth Standard	0
,, Sixth Standard	9
,, Seventh Standard	1
Secondary—First Standard	108
,, Second Standard	82
,, Third Standard	38
,, Fourth Standard	81
,, Fifth Standard	19
,, Sixth Standard	87
,, Seventh Standard	5
Collegiate	1
Adults attending no school	2
TOTAL ...	1,074

The number of boys is 638 and the number of girls 436. Kannada-speaking children number 739 and Marathi-speaking children number 335.[1]

[1] The mean I.Q. of children tested with the Kannada version was 99.62 with a σ of 18.01 and that of children tested with the Marathi version was 100.21 with a σ of 19.74. The difference of the two means is statistically quite insignificant. The scatter of Marathi-speaking children was a little wider, because on the one hand there were some most intelligent children of the highest officers and on the other there were some very backward children belonging to the menial classes.

The following table gives the mean chronological age and the mean mental age in each standard:

AVERAGE AGES STANDARD BY STANDARD

Standard	Mean chronological age	Mean mental age	Chronological age in round figures
Primary—Infants ...	6.5	5.7	6.5
,, Standard I ...	8.3	7.2	7.5
,, Standard II ..	8.8	8.1	8.5
,, Standard III ...	9.8	9.5	9.5
,, Standard IV ..	10.8	10.4	10.5
Secondary—Standard I ...	11.9	12.5	11.5
,, Standard II ...	13.1	13.6	12.5
,, Standard III ...	14.2	14.7	13.5
,, Standard IV ...	14.7	15.0	14.5
,, Standard V ...	15.8	16.4	15.5
,, Standard VI ...	16.8	16.6	16.5
,, Standard VII	17.6	16.5	17.5

For many educational purposes we are required to know the average age of children in the several standards. It will be safe to take the figures in the last column for such purposes. It may be noted that the mental ages in Standard V onwards are constant.

Changes Made in the Sub-tests. When a main test is made up of 3 or 4 sub-tests, it is presumed that each of these sub-tests is nearly of equal difficulty. Otherwise if one or two of these were too difficult as compared with the rest, the score of the whole test would be determined by the difficult sub-tests only and easier sub-tests would seem to be unnecessary. The easier sub-tests, therefore, could safely be removed without affecting the test as a whole. For example, in the test of giving the date, the day of the week and the day of the month are given by children of the seventh year, while the name of the month and year can be given only by children of the tenth year. Hence

if all the four sub-tests are grouped this way it becomes a tenth-year test as also if the test be made up only of the name of the month and the year. There would be no sense in retaining all the four sub-tests when two serve the same purpose. Hence the test is sub-divided into two parts, one part, 'giving day of week and day of month', being placed in year VII, and the other, 'giving name of month and year', being placed in year X. In the same way in the test of naming coins, the 1/8 rupee coin is the hardest and the score is determined in most cases by the answer to this coin. This test is also in two parts, 'naming four coins' going to year V and 'naming six coins' to year VIII. The test of naming 4 coins really becomes a test of naming 3 coins as the fourth one, the 1/4 rupee coin, is the hardest and only 3 correct answers out of 4 assigned to this age are required to be correct.

CHAPTER VI

THE CONCEPT OF THE INTELLIGENCE QUOTIENT AND ITS SIGNIFICANCE

THE Concept of the Intelligence Quotient. As has already been remarked, Binet compared different children by first finding out their mental ages and then noting by how many months or years a particular child was advanced or retarded from the median child of that age. This method was scientifically faulty.[1] A retardation of one year in the case of a child of six years was more serious than the same amount of retardation in the case of a child of twelve years. Further it was observed that by the time a normal child of six years' mental age grew up to the mental age of twelve years, a child of the same chronological age and five years' mental age grew up roughly to one of ten years' mental age. This means that a gap of one year at the lower level became one of two years at the upper level. These gaps, therefore, were intrinsically equal, though outwardly the latter gap was double the former. Hence it was found that it was not proper to compare children merely by their mental ages. A child of the chronological age of four years having a mental age of three years was almost on the border of mental deficiency, while one of sixteen years of age having a mental age of fifteen years was quite normal. Hence an absolute measure to compare children of different ages was required. This was supplied by the German psychologist, Stern, in the form of the Intelligence Quotient, by some called the Mental Ratio. Thus the mental age of a child as determined by the Binet scale is divided by the child's chronological age and this fraction has been found to remain practically constant, throughout a child's life. It is then multiplied by 100 to obtain an integral value for this quotient. Thus:

$$\text{I.Q.} = \frac{\text{M.A.}}{\text{C.A.}} \times 100$$

Subsequently it was Terman who made very large use of this concept of I.Q. and showed how it could be used for practical

[1] It is true that Binet pointed out that a greater retardation was required at a higher age for the same amount of mental deficiency.

purposes in our schools and in psychological laboratories to detect mental deficiency.

Mentally Deficient Children. There seems to be no unanimity on the subject as to what percentage of children of the general population is to be regarded as definitely mentally defective or what exact criterion or criteria should be applied to determine mental defect. On this question Burt says:[1] 'For the percentage of the population which is mentally deficient, assessments made by Royal Commissions and by acknowledged experts conflict and differ almost beyond belief. They reach from under 0.2 per cent to over 5.0 per cent, that is, from about one in five hundred to about one in twenty. One estimate thus recognizes twenty-five times as many defectives as another. Upon what scale is an education authority, such as that for the county of London, to provide when one calculation declares that between the ages contemplated 22,500 children will be defective and another only 900?'

Theoretically the safest course would be to begin the study of children from the lowest I.Q.s and work upwards[2] and roughly determine at what level children may be said to cross the borderline of mental deficiency. But there is bound to be no exact line of demarcation as no such exact line exists in any branch of knowledge or science. Even after determining such a line of demarcation roughly, doubts will be thrown on our own classification, as children who would be found to be definitely feeble-minded, when viewed from certain points of observation, would be found to be quite normal when viewed from other points or vice versa. Let us see what criteria different people have previously used.

The English Mental Deficiency Act of 1927 defines mental defectiveness as a condition of arrested or incomplete development of mind existing before the age of eighteen years, whether arising from inherent causes or induced by disease or injury.

The same Act defines the several grades of mental defectives in terms of social efficiency as follows:[3]

[1] Cyril Burt, *Mental and Scholastic Tests*, p. 163.

[2] Burt says we can approach the subject in two ways, either working upwards from the lowest I.Q. or working downwards from the normal children. According to him, we thus have two thresholds and not one.

[3] Pp. 18-19 of the *Report of the Mental Deficiency Committee* (H. M.'s Stationery Office, 1929).

(*a*) Idiots, that is to say, persons in whose case there exists mental defectiveness of such a degree that they are unable to guard themselves against common physical dangers.

(*b*) Imbeciles, that is to say, persons in whose case there exists mental defectiveness which, though not amounting to idiocy, is yet so pronounced that they are incapable of managing themselves or their affairs or, in the case of children, of being taught to do so.

(*c*) Feeble-minded persons, that is to say, persons in whose case there exists mental defectiveness which, though not amounting to imbecility, is yet so pronounced that they require care, supervision and control for their own protection or for the protection of others or, in the case of children, that they appear to be permanently incapable by reason of such defectiveness of receiving proper benefit from the instruction in ordinary schools.

This line of demarcation being indefinite Professor Burt suggests fixing the number of mentally deficient children on the number of places available in special schools in London and recommends separating out the lowest 1.5 per cent of children as mentally deficient. Thus the criterion is based on this percentage of the general population of children as determined by mental tests. This is equivalent to an I.Q. of about 70 according to Burt's data; so that all children below I.Q. 70 he would put down in this category. He bases his definition of a mentally deficient child on this fact and says: 'The mentally defective child is to be defined as one who for intelligence ranks among the lowest 1½ per cent of the school population of the same age.' A good many of the children in the upper range of this class grow up into adults who can reasonably manage their own affairs and do not require strict supervision. He therefore recommends a lower percentage for adults, namely 0.5 per cent, of the general population for being regarded as mentally deficient. This is also based on the number of places available for mentally deficient adults in the special institutions in London. This is equivalent to a mental age of 8 years or an I.Q. of about 50. So all adults below I.Q. 50 he would regard as mentally deficient.

The 1.5 per cent children of special schools, i.e., schools for the mentally defective, Burt would further divide as follows according to the care they would require when they grow to be adults—the lowest 0.5 per cent as ***institution cases***; the

next higher 0.5 per cent as *supervision cases*; and the highest 0.5 per cent as *special school cases*.[1] He says: 'In mental ratios these percentages indicate the following rough lines of demarcation. *Below* 50, *institution cases*; *between* 50 *and* 60 *supervision cases*; *between* 60 *and* 70 *special school cases*. With adults, and with adolescents over sixteen, these limits correspond to the mental ages of eight, nine and a half, and eleven respectively.'

Classification of Children according to I.Q.s. Terman classifies the children in his investigation into the following categories:

Class	Range of I.Q.s	Percentage of general population[2]
'Near' genius or genius	Above 140	0.5
Very superior intelligence	120—140	6
Superior intelligence	110—120	14
Normal or average intelligence	90—110	60
Dull	80— 90	14
Borderline deficiency	70— 80	5
Definite feeble-mindedness	Below 70	1

The one per cent feeble-minded ('mental defectives' according to the British terminology) he further divides into the following classes:

Class	Range of I.Q.s
Morons	50 to 70
Imbeciles	20 to 50
Idiots	Below 20

He says: 'According to this classification the adult idiot would range up to about 3-year intelligence as the limit, the adult imbecile would have a mental level between 3 and 7 years, and the adult moron would range from about 7-year to 11-year intelligence.'

[1] Professor Burt is rather ambiguous here in saying that the 1.5 per cent of *special school children* contain 0.5 per cent of *special school cases*.

[2] The figures in this column are not given directly by Terman; but they have been worked out approximately from his data.

Coming now to our own data we might classify our children as follows, remembering that the standard deviation of the scatter of our children is about one-and-a-half times that of Terman:

Class	Requirements of the class	Range of I.Qs.	Percentage of the general population	
			Actual	Smoothed
Near genius or genius	Special attention by parents and state	140 and above	2.00	1.5
Extraordinary	Special classes in ordinary schools	130–139.9	3.62	3.5
Very superior	Do.	120–129.9	7.10	9
Superior	Do.	110–119.9	14.43	15
Average or normal	Ordinary schools	90–109.9	42.73	42
Backward	Special classes in ordinary schools	80– 89.9	15.50	15
Very backward	Do.	70– 79.9	10.50	9
Borderline	Do.	60– 69.9	3.20	3.5
Mental defectives:				
Morons	Special schools	40– 59.9		
Imbeciles	Institutions	20– 39.9	0.93 (morons only)	1.5
Idiots	Do.	Below 20		
		TOTAL	100	100

It will be seen that according to the above scheme the same percentage, namely 1.5, of children are recommended to be cut off for special schools and institutions for mentally deficient children as that of Burt. Following Burt we could divide these 1.5 per cent children into three classes according to adult needs, the highest 0.5 per cent (I.Q.s 50 to 60) would probably go out as normal after their education in special schools, the next 0.5 per cent would be supervision cases (I.Q.s 40 to 50), and the lowest 0.5 per cent would be fit for special institutions throughout

[1] These percentages are only tentative. According to Dr Lewis' investigation in England out of every 100 mental defectives 5 are idiots, 20 imbeciles and 75 feeble-minded (or morons).

their lives (I.Q.s below 40).[1] Taking now, for illustration, a city like Bombay with a population of a little over one million[1] it will be seen that 1.5 per cent, i.e., 1,500 of its children should be separated out as mentally deficient.[2] Special instruction should be provided for the highest 1,000 of them in special schools. The remaining 500 will be more or less uneducable and housed in institutions or colonies as indicated above. Such children derive no benefit at all from attending ordinary schools.

It is the first duty of the municipal corporations of the large cities to attend to the needs of the growing generation, yet in no city in India up to the present time has any such special school been started. Perhaps one reason for this has been the absence of a good measuring instrument but after the publication of the present scale it is hoped that Bombay and similar progressive cities will wake up to their duties and take immediate steps to establish special schools and institutions. What is said above about mentally *defective* children applies, *mutatis mutandis*, to *superior* children. They are the assets of the nation and under special instruction in special schools, they would undoubtedly help to raise the country in the eyes of the world. The individualistic attitude in education is condemned in all progressive countries at the present day and it is recognized that there is a place in this world for everybody, however humble. It is team work and not individual glory that helps the members of any community to progress in ways which will result in advantage to the whole community.[3] Modern enlightened states regard it as their duty to measure the calibre of every child's mind and to provide him with an education which will fit him for life in an organized society.

[1] The population of Greater Bombay today is much more, more than twice as much.

[2] For this calculation 10 per cent of the population are regarded as of school-going age.

[3] See Godfrey H. Thomson, *A Modern Philosophy of Education*, Ch. X, p. 192.

'The idea of falling into one's place must be inculcated by the life of the school, which must cease to look upon success as a kind of linear thing, with only a top and a bottom, and must rather think of success as meaning fitting into place in a team even if that place be not one requiring very rare talents.'

CHILDREN BELOW I.Q. 60

Serial No.	Distinguishing mark of child	Sex	I.Q.	Chronological age		Mental age		Retardation mentally		Class in which studying
				Yr.	M.	Yr.	M.	Yr.	M.	
1	978 J G.B.	Girl	49	11	4	5	6	5	10	Primary I
2	715 M.A.H.	Girl	52	11	9	6	1	5	8	Primary I
3	966 T.S.T.	Girl	52	10	7	5	6	5	1	Primary (infants)
4	1010 S.M.R.	Girl	52	13	2	6	10	6	4	Primary II
5	139 R.C.N.	Boy	59	15	4	9	4	6	0	Primary IV
6	353 D.S.Y.	Boy	59	11	1	6	7	4	6	Primary (infants)
7	643 P.V.G.	Boy	56	15	0	8	4	6	8	Secondary I
8	778 G.V.R.	Girl	59	16	11	9	5	7	6	Secondary II
9	984 M.S.T.	Girl	58	11	5	6	8	4	9	Primary I
10	985 V.Y.N.	Girl	59	11	8	6	10	4	10	Primary I

(FEEBLE-MINDED)

Average age for class in which child is studying	Advancement or retardation in School	Social class	Father's Occupation	Remarks
7·5	Yr. 4 retarted	Brahmin (class I)		Physically well-built and appeared normal
7·5	4 ,,	Maratha (class II)		
6·5	4 ,,	Bhavasar-kshatriya (class II)	Tailor	
8·5	5 ,,	Brahmin (class I)	Revenue clerk	
10·5	5 ,,	Lingayat (class II)	Railway workshop servant	
6·5	$4\frac{1}{2}$,,	Kurub (class III)	Peon	
11·5	$3\frac{1}{2}$,,	Brahmin (class I)	No father	
12·5	$4\frac{1}{2}$,,	Brahmin (class I)	Clerk	Physically well-grown, rather fat
7·5	4 ,,	Simpi (class II)	Tailor	
7·5	4 ,,	Brahmin (class I)	Tea hotel keeper	

The percentages in the table on p. 84 are obtained by smoothing the actual graph, and making it an ideal one so as to fit as best as it can the actual figures. Thus the actual percentage of children below I.Q. 60 was nearly 1,[1] while we have set it down as 1.5, that of children between 60 and 69 I.Q. was 3.2, while we set it down as 3.5 and that between 70 and 79 was 10.5, while we have set it down as 9. For theoretical purposes and permanent use we require the figures obtained by smoothing the curve by the usual statistical devices and not the actual figures which may deviate slightly from the ideal curve.

The above are the only 10 children in our study belonging to the feeble-minded class. Five of them belonged to the highest class socially,[2] namely the Brahmins, and the other five to the non-Brahmin classes. All of them were retarded 4 to 5 years in school work. By occupation all of them belonged to the lower classes. They were all in ordinary schools, 8 of them in primary and 2 in secondary schools, 7 girls and 3 boys. All of them were doing very poor work in school and seemed to derive very little benefit from ordinary instruction. They ought to be taught in a special school for the feeble-minded or in special classes. Such schools are not possible in our smaller town with a primary school population of two or three thousand because in this population there will be only about 20 or 30 such children. Such of the municipal boroughs as wish to try the experiment may, however, include the $3\frac{1}{2}$ per cent border-line cases and establish special schools for both groups together.

It will be observed that all the 10 children belong to the moron class according to our classification. As very few of the imbeciles and none of the idiots are sent to school by their parents it is very difficult to say from such a study of school children as this what percentage of imbeciles and idiots there is in the general population of children. The 10 morons or feeble-minded in this study form one per cent of the total population and this

[1] An estimated 0.5 per cent of imbeciles and idiots together added to the actual 0.93 per cent of morons of this study would make a total of 1.43 per cent defectives below I.Q. 60.

[2] If comparison is to be made of the social groups as regards the number of defectives and others the number of children actually tested in each social group and given on page 76 should be taken into consideration.

agrees with Burt's estimation. Following Western investigations we may regard the imbeciles and idiots together as forming 0.5 per cent.

Of the 34 borderline cases 14 were boys and 20 girls. Only 3 of them were in the lowest standard of the secondary schools and 30 in primary schools and one belonged to the pre-school period. On an average they were retarded about 3 years in school studies. Nine belonged to class I socially, 23 to class II and 2 to class III. This works out to 1.4 per cent of the advanced, 5.7 per cent of the intermediate, and 11.8 per cent of the backward classes. The occupations of the parents of most of the children were of the middle or lowest order.

The group of children between I.Q.s 70 and 79 are what we have called 'very backward' children. Those from 80 to 89 we have called 'backward' children. Both these kinds of children may be taught in special classes forming the 'lower stream' in ordinary schools. They comprise about 24 per cent of the general population of children.

The children between I.Q.s 90 and 110 are what we have designated 'normal' or 'average' children. They form 42 per cent of our unselected population of children. If the group is enlarged to include 50 per cent of median children the range of I.Q.s will extend from about 88 to about 112. For convenience we have made the group slightly smaller by including only cases between 90 and 100 I.Q.s. This group might form the middle stream of children in our ordinary schools.

The children between 110 and 120 form the class of 'superior' children and those between 120 and 130 form the class of 'very superior' children. They might well form the 'upper stream' in our ordinary schools, comprising about 24 per cent of the population of children.

The tables on pages 94-5 give an analysis of these three classes of children.

The next class is that of 'extraordinary' children. Their analysis is shown in the second table on page 95.

The four tables make it clear that, as a rule, the greater the mental retardation of a child the more the child is retarded educationally. The mentally superior children, however, are not so much above the standard, as would be expected by their mental superiority. This is due to the fact that children are

CHILDREN WITH I.Q.s 60-69

Serial No.	Distinguishing mark of child	Sex	I.Q.	Chronological age		Mental age		Retardation mentally		Class in which studying
				Yr.	M.	Yr.	M.	Yr.	M.	
1	93 H.H.B.	Boy	66	13	11	8	10	5	1	Secondary I
2	140 K.V.C.	Boy	63	14	0	8	10	5	2	Primary IV
3	170 G.F.L.	Boy	68.8	7	9	5	4	2	5	Primary (infants)
4	181 P.S.R.	Boy	67	10	4	6	11	3	5	Primary III
5	187 S.Y.F.	Boy	68.6	13	0	8	11	4	1	Primary II
6	209 M.P.V.	Boy	67	11	4	7	7	4	0	Primary IV
7	312 P.A.R.	Boy	60.3	5	3	3	0	2	3	Primary (infants)
8	321 S.M.C.	Boy	63	5	3	3	2	2	1	Primary (infants)
9	327 E.R.A.	Boy	68	14	0	9	6	4	6	Primary IV
10	337 W.V.S.	Boy	67	12	6	8	5	4	1	Primary IV
11	366 C.D.B.	Boy	68	10	0	6	10	3	2	Primary III
12	373 H.S.S.	Boy	67	14	6	9	8	4	10	Primary III
13	416 B.L.B.	Girl	67	7	2	4	10	2	4	Primary (infants)
14	443 M.L.J.	Girl	64	9	7	6	2	3	5	Primary (infants)
15	447 M.T.V.	Boy	65·5	12	10	8	5	4	5	Primary II

(BORDERLINE CASES)

Average age for class in which child is studying	Advancement or retardation in School	Social class	Father's occupation	Remarks
	Yr.			
11·5	2 retarded	Myadar (class III)	Basket-weaver	
10·5	3½ ,,	(class II)	No father, Guardian, millowner	
6·5	1 ,,	Maratha (class II)	Household menial servant	
9·5	1 ,,	Maratha (class II)	Gymnast	
8·5	4½ ,,	Kurub (class II)	Farmer	
10·5	1 ,,	Brahmin (class II)	Retired Government servant of middle class	Has two brothers both normal and two sisters — one normal and one backward
6·5	1 advanced	Maratha (class II)	Gymnast	Brother also retarded
6·5	1 ,,	Maratha (class II)	Peon	
10·5	3½ retarded	Christian (class II)	Clerk	
10·5	2 ,,	Brahmin (class I)	Farmer	
9·5	½ ,,	Maratha (class II)	Railway coolie	
9·5	5 ,,	Lingayat (class II)	Dead. Guardian-sister, a labourer	
6·5	½ ,,	Brahmin (class I)	Kulkarni, village accountant	
6·5	3 ,,	Maratha (class II)		
8·5	4 ,,	Lingayat (class II)	Railway menial servant	

Serial No.	Distinguishing mark of child	Sex	I.Q.	Chronological age	Mental age	Retardation mentally	Class in which studying
				Yr. M.	Yr. M.	Yr. M.	
16	538 K.L.	Girl	60	10 10	6 6	4 4	Primary (infants)
17	541 B.H.B.	Girl	68·5	8 9	6 0	2 9	Primary (infants)
18	548 Y.D.M.	Girl	68	11 4	7 9	3 7	Primary II
19	704 N.A.R.	Girl	67	8 11	6 0	2 11	Primary I
20	732 A.D.G.	Girl	69·5	14 7	10 2	4 5	Secondary I
21	744 B.A.B.	Girl	67	13 0	8 9	4 3	Secondary I
22	772 M.N.G.	Girl	65	11 8	7 7	4 1	Primary I
23	834 S.A.P.	Boy	69	13 4	9 2	4 2	Primary IV
24	899 G.C.	Girl	64	4 2	2 8	1 6	No school
25	910 J.S.T.	Girl	69 2	7 7	5 3	2 4	Primary (infants)
26	953 T.T.V.	Girl	65·5	9 2	6 0	3 2	Primary (infants)
27	962 K.A.J.	Girl	62·5	9 4	5 10	3 6	Primary (infants)
28	967 I.J.	Girl	62·1	7 3	4 6	2 9	Primary (infants)
29	968 S.S.Y.	Girl	65	7 8	5 0	2 8	Primary (infants)
30	973 B.S.H.	Girl	60	10 6	6 4	4 2	Primary I
31	975 M.P.N.	Girl	61·5	9 9	6 0	3 9	Primary I
32	986 J.S.G.	Girl	64	9 4	6 0	3 4	Primary I
33	1002 L.T.B.	Girl	68	7 7	5 2	2 5	Primary (infants)
34	1005 P.A L.	Girl	64	6 0	3 10	2 2	Primary (infants)

Average age for class in which child is studying	Advancement or retardation in School		Social class	Father's occupation	Remarks
	Yr.				
6·5	4	retarded	Brahmin (class I)	Father dead. Guardian, a painter	
6·5	2	,,	(class II)		
8·5	3	,,	Christian (class II)	Menial servant	
7·5	1	,,	Brahmin (class I)	Father dead	
11·5	3	,,	Brahmin (class I)	Officer, Engineering Department	
11·5	1½	,,	Brahmin (class I)	Father dead (was a pleader)	
7·5	4	,,	Brahmin (class I)	Govt. clerk	
10·5	3	,,	Maratha (class II)	Father dead. Mother dealer in vegetables	
...	...	...	Lingayat (class II)	Pleader	
6·5	1	retarded	Simpi (class II)	Tailor	
6·5	2½	,,	Simpi (class II)	Cloth merchant	
6·5	3	,,	Maratha (class II)	Menial servant	
6·5	½	,,	Simpi (class II)	Tailor	
6·5	1	,,	Maratha (class II)		
7·5	3	,,	Simpi (class II)	Tailor	
7·5	2	,,	Simpi (class II)	Cloth merchant	
7·5	2	,,	Simpi (class II)	Tailor	
6·5	1	,,	Maratha (class II)	Farmer	
6·5	...	,,	Brahmin (class I)	Mechanic	

VERY BACKWARD AND BACKWARD CHILDREN
I.Q.s 70 TO 89

School	2 or more years retarded in class standing	Less than 2 years retarded	In normal class in school	Less than 2 years advanced in class standing	2 or more years advanced in class standing
Primary	119 children 61·3%	52 children 26·8%	22 children 11·4%	1 child 0·5%	nil
Secondary	53 children 82·8%	7 children 10·9%	4 children 6·3%	nil	nil

NORMAL CHILDREN. I.Q.s 90 TO 109

School	2 or more years retarded in class standing	Less than 2 years retarded	In normal class in school	Less than 2 years advanced in class standing	2 or more years advanced in class standing
Primary	49 children 23·8%	71 children 34·5%	73 children 35·4%	13 children 6·3%	nil
Secondary	94 children 49%	60 children 31·2%	27 children 14·1%	11 children 5·7%	nil

SUPERIOR AND VERY SUPERIOR CHILDREN
I.Q.s 110 TO 129

School	2 or more years retarded in class standing	Less than 2 years retarded	In normal class in school	Less than 2 years advanced in class standing	2 or more years advanced in class standing
Primary	7 children 7·8%	27 children 30·0%	37 children 41·1%	18 children 20·0%	1 child 1·1%
Secondary	28 children 24·8%	36 children 31·9%	32 children 28·3%	13 children 11·5%	4 children 3·5%

EXTRAORDINARY CHILDREN. I.Q.s 130 TO 139

School	2 or more years retarded in class standing	Less than 2 years retarded	In normal class in school	Less than 2 years advanced in class standing	2 or more years advanced in class standing
Primary	nil	3 children 37·5%	2 children 25%	1 child 12·5%	2 children 25%
Secondary	2 children 7·7%	5 children 19·2%	8 children 30·8%	8 children 30·8%	3 children 11·5%

generally sent to school for the first time about the same age and the one-year-one-standard rule is rigorously followed in Indian schools. Hence as the educational retardation of backward children goes on becoming wider and wider in the upper standards owing to a number of detentions, there are few cases of advancement in school promotions as a result of superior intelligence.

Lastly, we give an analysis of the children of the 'genius'

CHILDREN OF 'GENIUS' OR 'NEAR GENIUS' CLASS

Serial No.	Distinguishing mark of child	Sex	I.Q.	Chronological age		Mental age		Advancement mentally		Class in which studying
				Yr.	M.	Yr.	M.	Yr.	M.	
1	9 K.D.V.	Boy	152	10	6	16	0	5	6	Secondary II
2	13 K.K.L.	Boy	151	10	1	15	2	5	1	Secondary I
3	15 D.R.T.	Boy	176	10	3	18	0	7	9	Secondary II
4	16 S.U.V.	Boy	152	5	4	8	1	2	9	Primary (infants)
5	40 S.M.R.	Girl	143	10	10	15	6	4	8	Primary IV
6	73 S.M.A.	Boy	146	11	8	17	1	5	5	Secondary II
7	77 W.C.R.	Boy	146	9	0	13	2	4	2	Primary IV
8	94 T.M.S.	Boy	147	10	9	15	10	5	1	Primary IV
9	102 S.P.D.	Boy	140	10	9	15	0	4	3	Secondary I
10	111 S.S.D.	Boy	159	9	2	14	7	5	5	Secondary I
11	134 D.V.D.	Boy	142	8	11	12	8	3	9	Primary IV
12	228 K.G.S.	Boy	165	12	0	19	9	7	9	Secondary III
13	261 P.P.P.	Boy	142	10	9	15	2	4	5	Secondary II
14	561 K.S.S.	Girl	149	9	5	14	0	4	7	Secondary I

or 'near genius' class, I.Q.s 140 and above. There were 22 of them in this study, 16 boys and 6 girls. Socially 21 of them belonged to class I, that is the advanced class, and only 1 to the intermediate class or class II. Sixteen of them were educationally advanced to the extent of one year or more, 3 of them were in the normal class and 3 belonged to the pre-school period. Their parents' occupations showed that they were almost all from superior homes.

I.Q.s 140 AND ABOVE

Average age for class in which child is studying	Advancement or retardation in School	Social class	Father's occupation	Remarks
	Yr.			
12.5	2 advanced	Brahmin (class I)	Secondary school teacher	
11.5	1 ,,	Brahmin (class I)	Police officer	
12.5	2 ,,	Brahmin (class I)	College professor	
6.5	1 ,,	Lingayat (class II)	Commercial businessman	
10.5	... ,,	Brahmin (class I)	Pleader	
12.5	1 ,,	Brahmin (class I)	Father dead. Guardian, merchant	
10.5	1½ ,,	Brahmin (class I)	Forest clerk	
10.5	... ,,	Brahmin (class I)	Secondary teacher	
11.5	1 ,,	Brahmin (class I)	Secondary teacher	
11.5	2 ,,	Brahmin (class I)	Primary school teacher	
10.5	1½ ,,	Brahmin (class I)	Officer revenue department	
13.5	1½ ,,	Brahmin (class I)	Officer revenue department	
12.5	1½ ,,	Jain (class I)	Contractor	
11.5	2 ,,	Brahmin (class I)	Pleader	

Serial No.	Distinguishing mark of child	Sex	I.Q.	Chronological age		Mental age		Advancement mentally		Class in which studying
				Yr.	M.	Yr.	M.	Yr.	M.	
15	571 K.P.D.	Boy	143	10	0	14	4	4	4	Secondary I
16	585 T.K.K.	Girl	147	4	1	6	0	1	11	Nil
17	601 H.S.V.	Girl	141	2	3	3	2	0	11	Nil
18	645 K.R.S.	Boy	158	10	7	16	9	6	2	Secondary I
19	798 J.V.V.	Girl	156	12	10	20	0	7	2	Secondary III
20	845 P.S.D.	Boy	142	9	6	13	6	4	0	Primary IV
21	894 K.M.S.	Boy	142	2	0	2	10	0	10	...
22	1034 N.K.S.	Girl	146	9	4	13	7	4	3	Primary IV

Average age for class in which child is studying	Advancement or retardation in School	Social class	Father's occupation	Remarks
	Yr.			
11.5	1½ advanced	Brahmin (class I)	Landlord	
...	... ...	Brahmin (class I)	Government officer	
...	... ...	Brahmin (class I)	Landlord	
11.5	1 advanced	Brahmin (class I)	Judicial officer	
13.5	1 ,,	Brahmin (class I)	Pleader	
10.5	½ ,,	Brahmin (class I)	Municipal officer	
...	... ...	Brahmin (class I)	Commercial agent	
10·5	1 advanced	Brahmin (class I)	Father dead	

GENERAL DIRECTIONS FOR GIVING THE TESTS

THE Examination Room. An ideal room for psychological testing is one where there is no external distraction, such as street noises, or the movement of children or other persons. In big cities it is almost impossible to get these conditions. Still a quiet room in a building remote from the main thoroughfares is good enough for the purpose. When once the child is warmed up to his work the minor noises dwindle down into insignificance. No children or servants should be allowed to move or loiter about the examination room or to peep inside through windows or window-panes. No movement of any sort, either of furniture or of window shutters by wind should be allowed as these are the most potent forces distracting the attention of children. The room should not be too large. If a part of a large room has to be used it should be screened off by opaque cloth curtains. There should be no noise in the rest of the room while testing is going on. There should be as little furniture as possible. Two or three chairs or stools and a big table are quite enough. The stool or chair on which the child is seated should be sufficiently high, so that any picture or paper or diagram that is presented can be looked at by the child from a convenient height above the table. The chair, or stool, of adults may be too low for a young child. All the apparatus or pictures of the examiner should not be spread on the table in front of the child. They should be kept out of sight and taken out one at a time as required. When a large number of children is to be examined one after another, it is very convenient and it saves much time, to keep such material in pigeon-holes serially arranged in a small cupboard made specially for the purpose. This cupboard should be kept on a side table with its face away from the child. The child should sit at the same table as the examiner, preferably on his left or on the opposite side. The table itself should be as bare as possible. If there is no assistant the examiner himself may write down the child's

answers; but there should be no temptation for the child to read what the examiner writes. For this purpose a small sloping writing desk or a recess in the table or a small separate table of a lower height may be convenient. There should be no pictures or drawings on the walls nor any attractive statues or other similar things in the room. Besides the examinee, the examiner and possibly his assistant, there should be no other person present in the room. Additional people, particularly parents, teachers, or those interested in the child always interrupt the work by trying to help the child. They will say the child knows the answer to the question but has not rightly grasped it and request it to be put in a different way or they will themselves give illustrations or the required answer itself before the child has had sufficient time to think, and will ask him if he does not know that. Even if they do not interrupt, the child is likely to be nervous or self-willed in their presence.

The Examiner and his Manners. Even more important than the choice of the room is the attitude of the examiner himself. He must be very tactful. He will meet with various kinds of children, some pleasant in manner, others most repulsive, some obedient and docile, others most refractory, some very eager to respond, others very silent. The examiner must therefore be patient and not lose his temper under any circumstances but always be cool and persevering. He must be very resourceful and ready to solve any difficulty on the spot. He must take the children into his confidence and be most friendly to them. A good and pleasant personality is a great asset to the examiner. Some people are by nature the greatest friends of children; they sympathize with them and become one with them and this temperament is very suitable for a psychological examiner. He must coax and cajole the child if necessary. He must take him for a short walk round the garden or the school building. Then he must gently ask him his name, his father's name, his surname, what he is learning, what his father is doing and so on. He must continue in the same strain until *rapport* is established. Then he can imperceptibly pass on to the regular business of testing. Children below the five-year level are generally self-willed and refractory. Nature has provided them with the instinct of self-preservation and this is only one of its many forms. It takes a long time to gain their confidence. Below

the seven-year level some time should always be spent in establishing *rapport*. Above this level children are generally quite willing to submit themselves to testing, but care should always be taken that the element of fear or shyness is totally banished before testing begins. In the course of the examination the examiner must guard himself against continuing the test too long until children become bored. The tests however are so varied that children usually pass on gladly from test to test without any boredom. In all our testing of more than a thousand children there were hardly half a dozen children who showed any signs of boredom.

General Conduct of the Examination. The detailed procedure in giving each test will be given in later chapters at the appropriate places. Here it will be worth while to consider certain general principles for conducting the examination. After *rapport* has been established and the attention of the child secured, he should be given the regular tests. The formula of the questions should always be most strictly adhered to in every letter. No supplementary questions, not specified in the body of the test, nor any instructions on the right method of answering are allowed. Nor should the examiner show his displeasure by word or gesture or criticize any reply the child may make. The delivery of the examiner should be slow and impressive. All the key words in the formula should be emphasized. Wherever instructions are given to repeat the formula this should be done after the lapse of the specified time and the examiner should wait for the answer until the end of the time prescribed. Below the five year mental level children are very fidgety and the great problem is to secure their attention. Here any number of repetitions are allowed except in the case of the 'repetition of the digits' and 'repetition of syllables' tests. Here the examiner should make sure that the child is attentive and then give the digits or syllables once only. In all other cases full details are given as to whether the question is to be repeated, if so how many times, and after what interval of time. In earlier revisions this point was not made very clear. In some cases the instructions merely stated that a question could be repeated but it was not stated how many times. Repetition makes a certain degree of difference as the more backward children comprehend a question better after two or three repetitions. Further, some of the questions were timed; but

there were several others to which the time limit was not set. If a child was silent there was no clue to whether he was trying in his mind to find out a solution or whether he was unable to answer the question. Thus the examiner had sometimes to sit a very long time and still the answer was not forthcoming. Hence all such questions are carefully timed in this revision; and if a question has to be repeated clear instructions are given as to the interval of time after which the question is to be repeated and how many times. Burt however cautions examiners against being too pedantic in this respect. He says in some kinds of tests, such as 'giving 60 words in 3 minutes', the time limit is to be observed correct to a fraction of a second while there are other tests, such as the 'comprehension' tests where the grace of a few seconds does not much matter. In the interests of uniformity, however, it is better to err on the side of being too punctilious rather than that of leniency, to which there would be no limit. So we feel that it is better to allow more time, but once the time is fixed, it must be adhered to most rigidly. The only exception to this would be when the child is inattentive or when his attention is distracted during the course of the examination. Here it would be legitimate to proceed to the next test and return to the one in hand a little later; or the test may be omitted and an alternative test substituted. In all cases the answers of children should be taken down verbatim. By using a few abbreviations or writing down the first letter of every word and later on filling in the gaps, the examiner can manage the whole thing without help. If the record forms supplied by the publishers are used, the whole thing can be managed on the back of these forms and the scoring and the calculations can be made on the front side of the same. The recording of answers in full is a great help. The answers can be checked at leisure later on, or if the method of scoring is to be altered this can be done at a convenient subsequent date. These records will be of value to other people who at some future period may wish to use them in the course of their research. Only in one instance, in 'giving 60 words in 3 minutes', it is not possible to take down every word of the answers without the help of an assistant. In this case it is enough if the classes of words only are taken down—such as 'things', 'animals', 'verbs', 'abstract nouns', and so on.

Certain points are to be remembered in handling different kinds of personalities among children. If the children are very timid and shy a good deal of time should be spent in making friends with them and in winning their confidence before testing begins. Remember that testing is useless unless the child willingly co-operates and puts forth his best efforts. If a child is cross or self-willed he must be coaxed and won over. His interest may sometimes be aroused by showing him pictures; he may be given some sweets; he may be lifted up and taken round and shown some interesting things, until he becomes friendly. Such methods are particularly important below the five-year mental level. The writer had on some occasions to spend fully an hour or even two before testing the children. With these little children it is better that the father or mother should be present but the parents should be made to understand that they are not to utter a single word in connexion with the testing. On rare occasions a word or two of threatening used by the father or mother has a healthy effect in steadying a refractory child. But such words should never be uttered except by the parents. A child should never be allowed to get nervous. Every test of intelligence has an emotional aspect in it. Hence always keep the child in an exhilarated condition up to the very end, so that the child finds pleasure in answering the questions. The writer has found several times children coming back and asking for another test. Always begin with questions which the child can answer without any effort and pass on to those more and more difficult. Binet would begin with questions of the same age as the child's true age. This is proper with normal children, but with defectives who are very much retarded these tests would be too hard and a beginning should be made at a year or two lower, or even lower still, at a point where the child answers the questions easily. Except with retarded children, it is useful to begin with tests of the same year as the child's, work upwards until the child can answer no more questions, and finally come back to tests that may have to be taken below the tests of the child's age. By this method you come to very easy questions towards the end of the examination when the child is tired and finds relief in them. Receive every answer from the child with approval and commendation. Never allow the child to know that his answer is wrong, but if the child himself

finds out that it is so and tells you, do not deceive him. Say he may be wrong but that does not matter and that you are sure he will do well in other questions; because once the child gets nervous further testing is useless. For this same reason never fix your gaze on the child. Some children are very hasty and rash in their answers, and in such cases it would be better just to give a gentle warning to them that they must think well before they give an answer. Some children may be suffering from natural defects, such as partial blindness, deafness, or impediments in their speech, and these should be noted carefully at the very beginning. As a rule the examiner discovers as the examination proceeds at what stage a child will fail to answer. Very backward children, however, are an exception. The range of their correct responses is wider. Sometimes they may fail to answer all the questions of one year but in the next age group they may answer one or two questions. Such children, therefore, should be carefully and thoroughly tested over a sufficiently wide range. In these cases the pluses in the higher ages should be put down to the credit of the children. Similarly, on rare occasions a child is found to pass all the tests of a year, but in the next lower year he may fail in one or two tests. Here these failures should be subtracted from his score. Burt says that if a child fails in one or two tests and recovers in the higher year and passes all the tests in the latter, the lower failures should be disregarded. But this would be unscientific. If such failures in lower years are to be disregarded similar pluses in higher ages will have to be disregarded in the same manner. Great care should be taken against tiring the children. To avoid this the examination should be taken in the earlier part of the day, and after about an hour's examination the child's attitude should be carefully observed for any signs of fatigue. If fatigue appears the testing should be suspended and resumed at a second sitting. Backward children are more liable to fatigue than normal or advanced children.

The examiner should never allow himself to be prepossessed in favour of or against a child from his or her appearance or manner of talking. Every answer should be scored objectively, purely on the merit of the answer. Some children, especially girls, chatter much and make a show of knowing much. But when you come actually to test them the real nature of the child's intelligence is soon disclosed.

The writer remembers one instance where a girl came forward with a good deal of talk and seemed to be very intelligent. After the test both the examiner and the girl were surprised at the low I.Q. It was noticed that the girl, in particular, was very displeased.

In such cases where the children score low and where they are likely to be depressed by the low score it is best not to let them know the result of the examination. Always keep the child active in mind; never allow him to droop into inattentiveness and lack of interest. This can be secured by giving tests of varied interest one after another. The arrangement of tests in the scale usually serves this purpose but where they are found too dull, the examiner should not hesitate to change the order and take up one which is likely to rouse the child's interest. Never allow long pauses in the course of the tests, nor pass from one question to another without giving sufficient time to the child to respond. If more than one child is called in for testing, only one child should be taken at a time and the others should be given some picture book or reading book to engage their minds. After the testing, each child should return straight to his class and should not discuss the test questions with other children. It is true they remember very little likely to be of much use to other children about to be tested but when a number of children, already tested, are discussing together, some of the important tests are likely to be disclosed. For the same reason, a duller or a younger child should always be tested before a more intelligent or an older child.

Method of Scoring. As stated above, in the case of normal children, begin with the tests of the year of the boy's age. It will be found that he will answer some of the tests but fail in a few. Work upward until the child cannot answer a single question of a whole year. Then come back to the years below his chronological age until the child answers all the tests of a year. Sub-tests should be scored plus or minus separately in the margin of the square assigned to a particular test and then the whole test should be scored plus or minus. In the back of the sheet the full answers of the child should be taken down word for word. The following is the front side of a typical scoring card fully marked as indicated above:

Date 12-11-1957
Name in full A B C
Date of birth 12-10-1947 Age 10-1
School X Std. IV (Primary)
Father's name and occupation P Q R
Caste with sub-caste Hindu—Brahmin
Teacher's estimate of intelligence A B C D E
Rank in the class 15 out of 25
Mother-tongue Kannada

Examiner E

Y. M.

M.A. = 7 — 0

6

4

7 — 10

$$\text{I.Q.} = \frac{94}{121} \times 100 = \frac{9400}{121} = 77.7$$

The calculation of the mental age is then very simple. Start with the age at which the child answers all the questions as the basic age. Then in the higher ages since there are six tests in each year, credit two months for each test scored plus. After the tenth year the age groups are XII, XIV, XVI, XIX, and XXII. This means that in the range of two years from the tenth to the twelfth year there are only six tests. Hence for each test scored plus in this group credit 4 months. The same is the case with the tests in the XIV and XVI year groups. In the next higher groups there are 6 tests over a range of 3 years. Hence credit 6 months for each test scored plus in the groups of XIX and XXII. Thus in the above test card the child, whose chronological age is 10 years and 1 month, has answered all the tests of year VII, 3 tests of year VIII, 2 of year IX, and no tests of year X. The calculation, therefore, runs as follows:

	Mental Age years	Mental Age months
All tests of year VII	7	..
3 tests of year VIII	..	6
2 tests of year IX	..	4
No tests of year X	..	..
Total Mental Age =	7	10

TEST AGE

Test No.	VII	VIII	IX	X
1	a + b — 1 e c — 1 e 		a + 	a — b —
2		a + 	a — b — c —	a — 2 e b — c —
3	a + 	a + b + c — 	a — b — c — d —	12 sec a — b — c —
4	5 sec a + b + c + 	a — b + c —  d +	a — b — c —	
5	20 sec 	a + b + c + d — e + f —		a — b — c +
6			41 words 	27 sec 1 fact
Alt. 1	a + b + 		18 words	
Alt. 2				
Alt. 3				

Taking another instance, we find that a boy of chronological age 15 years and 5 months passes all the tests of year XII, 5 tests of year XIV, 5 of year XVI, 4 of the 'superior adult' group (designated year XIX) and 3 of the 'very superior adult' group (year XXII). The calculation in this case is as follows:

		Mental Age	
		years	months
All	6 tests of year XII	12	..
	5 tests of year XIV	1	8
	5 tests of year XVI	1	8
	4 tests of year XIX	2	..
	3 tests of year XXII	1	6
	Total Mental Age =	18	10

The chronological age of the first child is 10 years and 1 month. The child is therefore retarded by 2 years and 3 months. Similarly the second child, the adolescent boy, is advanced by 3 years 5 months.

Following Binet if only 5 tests are used in each year, credit 0.2 of a year in age-groups III to X, 0.4 of a year in age-groups XII, XIV, and XVI and 0.6 of a year in age-groups XIX and XXII. If less than 5 tests are used in any age-group credit a corresponding fraction of a year.

Calculation of the Intelligence Quotient, and its Importance. Binet stopped at this stage. After finding the mental age, he said this child is normal or advanced or retarded by so many years. Any retardation of more than 2 years he regarded as serious. But it will be seen that a retardation of 2 years at the age of 5 is much more serious than a retardation of the same number of years at the age of 10 and still more serious than a retardation of the same number of years at 15. Repeated testing has disclosed the fact that a child that is retarded by 2 years at 5 lags further behind and is retarded by 4 years at 10 and by 6 years at 15. Hence Professor Stern suggested that what is more to our purpose is the finding out of the ratio between the mental age and the chronological age. As this would give a small fraction he multiplied this quotient by 100 and got a figure which he called the intelligence quotient. Thus:

$$\text{I.Q.} = \frac{\text{Mental age}}{\text{Chronological age}} \times 100$$

In the first of the above instances the mental age of the boy is 7 years 10 months and his chronological age is 10 years 1 month. Hence his intelligence quotient

$$(\text{I.Q.}) = \frac{\text{M.A.}}{\text{C.A.}} \times 100 = \frac{94 \text{ months}}{121 \text{ months}} \times 100 = 77.7$$

In the case of the second boy the I.Q.

$$= \frac{226 \text{ months}}{185 \text{ months}} \times 100 = 122.2$$

Thus as indicated above it has been found that the I.Q. of any child remains practically constant throughout his life. If this be so the method of intelligence testing will be a valuable means of foretelling what kind of a man or woman a particular child will turn out to be provided his or her intelligence is given full scope to develop in the normal way.

Precautions and Reservations in the Use of Intelligence Tests. In the first place great care is to be taken to see that the child is examined thoroughly. The average range of testing should extend over four to five years. The testing should go down until all the tests in that age-group are answered. In the next higher group 4 of the 6 tests, for instance, may be answered, in the next higher 2 out of 6, then probably 1 out of 6, and in the highest nil. This is only by way of illustration. The actual tests answered in each year may be any number but it will be seen that generally success will gradually diminish from 100 to 0 per cent. In the case of very backward children success is more uneven and the range also wider, extending over a greater number of age-groups. This is due to the fact that no tests of intelligence can be pure tests of intelligence. The element of every day experience is bound to come in. Thus backward children though they are mentally retarded have gained more experience because they have lived more years chronologically. It is true that their ability to pick up from every day experience depends upon their mental growth and an intelligent child picks up more things than a dull child from the same environment. But the very fact that a backward child puts in more years in life than an advanced child of the same mental age results in greater unevenness in the answering of tests by the backward child. Thus for example, the 'recognition of coins' test may be answered by a child who has not come up to that mental level,

simply because he has had more opportunities of handling these coins.

It has already been observed that the emotional aspect accounts for a good deal of success in children's responses. A shy, timid or nervous child may score much less than he deserves as he cannot do himself justice. Hence it is always better to check up the result of intelligence testing by other criteria such as teacher's estimate or the child's performance in school studies. It is in a very few cases, not even in one in a hundred, that the results of intelligence testing belie the true nature of children's intelligence. Lastly, the results of the testing of very young children should be taken with great caution. Such children, that is those below the four-year level, are often either very shy or very self-willed and do not answer the questions properly. Hence it is very difficult to know at times whether the child cannot or will not answer. These results therefore should be checked in other ways by consulting people who know the children well as compared to other children of the same age. It would be interesting to test the same children two years later and see how far the old results tally with the new. The opinions of parents are not always reliable. More often than not they have too high an opinion of their own children. Even foolish answers are hailed as signs of great intelligence or interpreted as meaning something which is not really present in those answers.

The Intelligence Quotient of Adults. The results of intelligence testing have proved that intelligence, as measured by these tests, does not increase beyond the sixteenth year of age. In other words, the percentage of children passing the several tests steadily increases from age to age until the sixteenth year. After this the percentage does not increase appreciably. Some workers, particularly those who have worked with group tests, adopt 14 years as the maximum limit of the growth of intelligence, while some others adopt 18 years as this limit. The majority of people however consider 16 years as the limit. If we adopt this it follows that whatever the age of an adult we shall have to regard him as a person of 16 years of age, and divide his mental age by 16 years only. Thus if a person's chronological age is 25 years and his mental age 18 years his I.Q. will be $\frac{18}{16} \times 100 = 112{\cdot}5$.

Language and Intelligence. The tests in this revision are all to be given in the language of the children. If they are given in a language over which the child has no mastery, he will be greatly handicapped. Kannada-speaking children with the Kannada version of the test do as well as Marathi-speaking children with the Marathi version or for that matter English children with the English version or French children with the French version, provided the wording is of equal difficulty in all the versions. This will be apparent from a study of the location of the various tests. In spite of the very great dissimilarity between the structure and usage of European and Indian languages the variations in the location of the Indian version of the tests is not greater than the variations of the tests in the European countries and America. It would appear therefore that it is not the form of the language that counts but the ideas that are called up by the language. It is a great mystery whether these ideas are identical with images—visual, auditory, kinaesthetic or what. When a person tries to learn a new language he finds in the earlier stages that each new word calls up an image of its own or is tacked on to the corresponding word in the language which he already happens to know perfectly.[1] Hence he requires time in comprehending anything in the new language. Later on these associative bonds between the words in the new language and the images of things they denote, become so strengthened that immediately the word is uttered it is identified with the image. When a person is rapidly delivering a lecture there is absolutely no time to call up the images, but the hearers comprehend the lecture quite well. Hence several psychologists affirm that imageless thinking does

[1] On one occasion the author made a small experiment on himself. Sitting idly at a friend's place when he was not at home a chart on the wall giving the names of pictures of objects in two languages attracted his attention. He knew one of the languages but did not know a good many words from the other language. He tried to learn the new words in the second language by associating the words with the *words* in the first language which he knew well. He found that his progress was very slow. Then he tried the method of associating the words in the new language with the *pictures* on the chart. He found that his progress this time was very rapid and he could learn almost all the words within two readings of the chart. This experiment deserves to be carried out on an extended scale and if this finding proves to be correct it would be a great triumph for the Direct Method of teaching languages in our schools, at least during the earlier stages.

exist. However, it appears to the writer that instead of calling such thinking imageless thinking it would be better to say that the associative bonds between words and images are so strong that the word is almost identified with the image that it calls up.

The Grouping together of Sub-tests. In putting together 3 or 4 sub-tests in any test of any age, care is to be taken that the percentage of children who pass each sub-test in any age-group should be very nearly the same. For example, in the 'comprehension' test of year IV there are 3 sub-tests. If we take the whole group of children in their fourth year the number of children in this group that pass the three sub-tests severally should be very nearly the same.

If there is very great disparity in this the test will be determined by the most difficult of the sub-tests and there would be no point in retaining the other sub-tests. Even when this test is to be scored on the basis of 2 correct responses out of 3 it is desirable that all the sub-tests should be of nearly equal difficulty. It is a problem in the theory of probability, if 60 per cent of the children of this age-group pass each of the sub-tests, what percentage of the same will pass 2 out of the 3? Strict mathematics would require us to group the sub-tests on the basis of this requirement. In practice we group together sub-tests of nearly the same difficulty and then score the test as a whole.

Alternative Tests. These tests are meant to be used only when any of the ordinary tests cannot for one reason or another be used. They are generally not so reliable as the others. The 'vocabulary' test though a good test with a high coefficient of correlation can only be used in one year, that is the highest year to which the score is appropriate, on the principle that the same test should as far as possible not be used in more than one year. The use of the test is further limited by the fact that it should be used only in the case of those children whose mother-tongue and medium of instruction at school are the same as the language of the test. If a child's mother-tongue is Marathi and the medium at school is Kannada or vice versa his vocabulary cannot be compared with that of a child whose mother-tongue and school medium are the same. Hence the vocabulary has been standardized by testing only those children whose mother-tongue is the same as the medium of instruction in their school.

CHAPTER VIII

TESTS FOR YEAR III[1]

III, 1. Pointing to Parts of the Body. (3 out of 4.)[2]

TEXT AND PROCEDURE

'Show me your nose.'

'Put your finger on your nose.'

Same with eyes, mouth and hair.

If two or three repetitions fail to bring a response, overcome timidity by pointing to chin or ear and questioning:

'Is this your nose?'

'No? Then where is your nose?'

Answering by winking, opening the mouth, etc., should be counted as satisfactory.

Remarks. Three correct responses out of four are required. This test is much easier than the next one—'naming objects'. At this stage the association between the name of an object and the object itself is made; but the association between this pair and the muscular movements of the vocal organization is not yet made. This illustrates beautifully the way in which our psychological organizations are slowly built up into more and

[1] In what follows, the text of the tests and the procedure in detail are given in English. The tests and test procedure in the two Indian languages Kannada and Marathi are published separately. The English version is given only for English readers and for comparison between this revision and previous revisions. It should, however, never be used with Indian children. With them the Indian language version which is their mother-tongue and the school language should only be used.

[2] This test is passed by nearly all the children who are just 2 years old. Being the first test of the third year it should naturally be passed by nearly all children who have completed 2 years and have not yet completed 3 years.

Really at this beginning of the scale we require smaller fractions of age than one year. It would be proper, for example, to take children between 2 years and 2 years and 2 months and require 50 per cent of these to pass this test. This would be the most scientific way of fixing this lower end. Similarly for III, 2 we should take children between 2 years 2 months and 2 years 4 months and so on.

more complex wholes. Further there is the question whether the child explores and studies its own body first or that of a doll or another person—its mother, brother, sister or servant. Probably it explores those limbs of its own which are visible to it, then those of a second person, then compares and generalizes in its own way and thus finally attains the concept of a nose, a mouth, a hand and so on.

III, 2. Naming Familiar Objects. (3 out of 5.)

TEXT AND PROCEDURE

Use (1) a key; (2) a pice; (3) a closed penknife; (4) a watch; and (5) an ordinary lead pencil (taking care to use things in common use).

'What is this?' or

'Tell me what this is.'

Remarks. This test is harder than the previous one as is evident from the percentage of children who pass it. The previous test requires the association of auditory images of the names of things and visual images. This test requires over and above this the association of kinaesthetic and muscular movement images with the previous group. Hence it is more advanced. It is interesting to note that the most common objects from the everyday experience of little children of this age selected by Binet hold good in such a different environment as the Indian. In scoring this test baby talk should be allowed. Children of this age pronounce the words in a strange way, or they use abbreviated forms of the names. It is doubtful, however, if onomatopoeic words should be allowed. Thus they call a clock or a watch a 'tick-tick'. This may mean that the child has not learnt to associate the proper name of the object with the object. The acquisition of onomatopoeic words comes earlier than that of proper names. On the contrary some children indulge in such talk and their parents encourage it out of endearment even after their vocabulary is sufficiently enlarged. If such is the case the test should be scored plus; otherwise minus.

III, 3. Repeating Two Digits. (1 out of 3. Order correct. Read 1 every half second.)

TEXT AND PROCEDURE

'Listen: say 4—2.' (Practice series)
'Now say: 3—7; 6—4; 7—2.'

Remarks. With little children the series should be given rather rapidly. Terman prescribes an interval of one second between two digits. This interval is found to be too long with very little children, who begin to utter a digit before the next digit comes. Hence one has to give the digits rather rapidly about one every half second. This test is in Binet's original test, but is omitted by Terman probably because he finds it too easy for year III. Burt has it in year III. With little children below the 4-year level it is very difficult to secure their attention. Hence the trial series and even the first series may be spoiled and may have to be repeated more than once, before attention is secured and silence broken. Then give the second and third series uttering them only once. There is very great divergence in the location of the repetition of 'digit' tests by the various workers. This difference is due mostly to want of uniformity in the procedure; some give the digits every half-second, others every second. Some will have done with the whole hierarchy of digits, one after the other. Others will give them in their appropriate places in the several age-groups. In particular, Burt's location of the test appears strange. His results must be due to the fact that he gives the whole hierarchy at once. On the one hand this means that, especially with the later tests, there has been much recent practice in the repetition of digits; on the other hand it might lead to fatigue towards the end. On the whole it appears that this procedure makes the test more easy.

In the present revision the tests are meant to be given only in their appropriate places in the several age-groups. The location of the several series by different workers is given below:

	Binet	Terman	Burt	Present revision
2 digits	III	..	III	III
3 digits	IV	III	IV	IV
4 digits	..	VI	V	VI
5 digits	VIII	VII	VI	VIII
6 digits	..	X (1 of 2)	VIII	XII
7 digits	XV	XIV (1 of 2)	XI	XVI (1 of 2)
8 digits	..	XIX	..	XXII

It will be seen that the location of the test in the present revision agrees best with Binet's.

III, 4. Enumeration of Objects in a Picture. (*At least two objects in any one picture are satisfactory for this test.*)

TEXT AND PROCEDURE

(*a*) Railway station.
(*b*) Reception.
(*c*) Motor accident.

Say,

'Now I am going to show you a pretty picture. Tell me what you see in this picture.'

'Look at the picture and tell me everything you can see in it.'

'Show me the—— ——.' (Only one such question is permissible.)

'That is fine; now tell me everything that you see in the picture.'

'And what else?'

Remarks. Present these pictures before the child in the order shown above. In order to pass this test the child must name at least *two* objects in any *one* picture *spontaneously*. This test is more difficult than naming actual objects. The additional difficulty here appears to be the transformation of pictures of two dimensions to actual objects of three dimensions. Of course, the pictures cast on the retina in any case are of two

dimensions and a skilful artist draws his pictures in perspective, but however skilful the artist the reality of the actual things is wanting in these pictures. Thus the front of the motor-car in picture No. 3 above is perceived by several children as a writing slate, though the same children would never make the mistake with the actual motor-car. This stage in the mental development of children is called by Binet 'the identification stage'. Terman calls it 'the enumeration stage'. Then comes the stage of description about the sixth year of age and finally the stage of interpretation about the twelfth year. What is required for description is the grasping of the properties or actions of individual things; for interpretation what is required is the grasping of the relation of all the things or objects and finding only one meaning for the whole picture. This test requires the highest type of conceptual process requiring analysis and synthesis. These pictures are selected from among a large number and are found to give the best results.

III, 5. Repeating Six to Seven Syllables. (1 out of 3.)

TEXT AND PROCEDURE

'Can you say, "mamma"?'

'Now say, "nice kitty".'

So much is for practice or to overcome shyness. Then continue asking the child to say,

(*a*) 'I have a little dog.'

(*b*) 'The dog runs after the cat.'

(*c*) 'In summer the sun is hot.'

Remarks. For a plus in this test any one of the three sentences must be correctly repeated after only one reading. There should be no transposition nor omission of any of the words. Indistinct talk owing to baby pronunciation should be ignored; for example, many children of this age cannot pronounce an 'r' or a 'k'. In Kannada or Marathi script each letter written is a complete syllable, but in the Roman script each syllable usually requires two or more letters. So although the number of written letters is less in the Indian scripts, ability to repeat speech depends only on sound, that is, only on the number of syllables. In this test the syllables to be repeated are syllables

having sense and not nonsense syllables. If they were nonsense syllables the number of syllables repeated would be much less. If the syllables are sense syllables somehow the associations of the meanings of words come to the help of children. Besides, familiar speech sounds require a number of muscular and vocal co-ordinations in which the child must have already had practice.

III, 6. Comparison of Lines. (3 out of 3: or 5 out of 6.)

TEXT AND PROCEDURE

Put the card before the child with the lines in a horizontal position. Say,

'Here are two lines. This is one and this is another. Look closely and tell me which one is longer. Put your finger on the longest one.'

Reverse the position of lines and say,

'Now show me the longest.'

Turn the card, make a third presentation and repeat the same formula.

Remarks. The greatest difficulty with children of the third and fourth years is to secure their attention. The children are very fidgety; after securing a child's attention, although you may place the card before him, he casts a casual glance at it and turns it over and looks at the other side. This is only one instance of the great *curiosity* of children in looking at things from different sides and of their pleasure in *doing* things and turning them and analyzing them. In order to fix their attention better and make the formula more acceptable we have added the words—'This is one and this is another.' The original formula, 'See these lines' is found to be too bald and unsuited to children of this age. They never wait to observe the lines very closely but turn over the card. At this age we have to repeat the formula again and again until attention is secured. So the original formula will have to be repeated several times until this object is attained. With the new formula attention is secured more quickly and hence it is better to use the new formula but it does not seem to make the test easier in any way. Terman uses the superlative form of 'long' also in the alternative formula. But in the Indian languages there are no single words

for superlatives and round about ways of signifying the superlatives are of no use. Hence one formula is enough. The child must point definitely to one of the two lines. If the child points to the wrong line never make a suggestion by look of displeasure or by any kind of sound; accept any kind of answer with equal coolness and encouragement. According to Binet, success in this test depends more on comprehension of directions than on actual discrimination of lengths.

III, Alternative 1. Giving Sex.

TEXT AND PROCEDURE

To a boy: 'Are you a boy or a girl?'
To a girl: 'Are you a girl or a boy?'
If there be no answer, say,
'Are you a girl?' (if a boy). 'Are you a boy?' (if a girl).
'Well what are you? Are you a boy or a girl?' (or vice versa).

Remarks. Note that with boys we end the question with 'a girl' and with girls we end it with 'a boy'. The reason is that children have a tendency to repeat the latter alternative without thinking. This is a form of automatism. The word 'little' in Terman's formula of 'a little boy' is omitted as it does not in any way improve the comprehension of the formula; on the contrary there is the tendency to contrast 'little' with 'big' as if the word 'little' were emphasized. Real sex consciousness is not required in answering this question; for children seem to make distinctions between boys and girls mostly by their dresses and costumes and by the way they are addressed in terms of pronouns. In giving the formula the words 'boy' or 'girl' should be clearly emphasized.

III, Alternative 2. Giving Proper Name.

TEXT AND PROCEDURE

'What is your name?'
'How do people call you?'

Remarks. This is a new test. Binet's test is to give the family name. It is not usual however with Indian children to be called by their family name nor does the family name of their

parents occur so often in daily household talk. Thus this test if it is to be retained at all goes to the fifth year. As the family name test was found to be unsuitable for this age, the proper name was tried and was found to give fairly good results. The test has, therefore, been put down as an alternative test for this year, as all the other proper tests of this year are better than this one.

Note on Location of Tests of Year III. In strict mathematical conformity the tests of this year must be arranged in order of difficulty in such a way that test 1 should be passed by about 50 per cent of children between 2 years and 2 years 2 months; test 2 should be passed by about 50 per cent of children between 2 years 2 months and 2 years 4 months; test 3 by 50 per cent of children between 2 years 4 months and 2 years 6 months and so on. The fractions of mental age to be determined for this year are very small and very significant and hence the scale is required to be more sensitive. The following table gives the percentage of passes for the several groups of children considered from this point of view. It should be noted, however, that the number of children in each such group is very small and hence too much importance should not be attached to the discrepancies that are found.

In the table on page 122, III, 1, III, 2, etc. are the first, second and so on tests of year III. The number of children examined for each age-group and each test is shown in brackets. Thus there were 9 children examined of chronological age 2 years 0 month to 2 years 2 months. All these passed the first test of year III; hence the percentage of passes for this group is 100 and the number of children is shown in brackets, as (9). Similarly 4 children were examined in the group 2 years 6 months to 2 years 8 months chronological age. Of these 3 passed the test III, 6; hence the percentage of passing this test is 75 and the number of children examined is shown in brackets below this as (4).

Percentage of passes with number of children examined

Age-group of children			III, 1	III, 2	III, 3	III, 4	III, 5	III, 6	III, Alt. 1	III, Alt. 2
Yr.	M.									
2	0	to	100%	33%	33%	22%	13%	0%	0%	25%
2	2		(9)	(9)	(9	(9)	(8)	(4)	(8)	(4)
2	2	to	100%	50%	68%	39%	25%	25%	13%	66%
2	4		(8)	(8)	(6)	(8)	(8)	(4)	(8)	(3)
2	4	to	100%	25%	33%	25%	0%	50%	0%	50%
2	6		(4)	(4)	(3)	(4)	(3)	(2)	(4)	(2)
2	6	to	100%	75%	100%	50%	75%	75%	50%	66%
2	8		(4)	(4)	(4)	(4)	(4)	(4)	(4)	(3)
2	8	to	100%	66%	100%	33%	66%	66%	33%	100%
2	10		(3)	(3)	(3)	(3)	(3)	(3)	(3)	(2)
2	10	to	100%	100%	100%	84%	70%	70%	56%	75%
3	0		(7)	(7)	(6)	(7)	(7)	(7)	(7)	(4)

CHAPTER IX

TESTS FOR YEAR IV

IV, 1. Repeating Three Digits. (1 out of 3. Order correct. Read 1 every half second.)

TEXT AND PROCEDURE

'Listen: say 7—3.' (Practice series)

'Now, say: 6—4—1; 3—5—2; 8—3—7.'

Remarks. See remarks under III, 3. If the examination of a child is to begin with this year don't begin with this test. Begin with the next test, 'discrimination of forms' or the next after that, 'comprehension first degree', and return to the earlier ones later on after shyness is overcome. If the child is self-willed or shows diffidence, coax him and say, 'I know you can repeat them all right.' Very often the first series will have to be repeated several times until silence is broken. Always observe the rule however, that only *three* attempts by a child are allowed and plus should be scored if any *one* attempt is correct after the series is given only *once* by the examiner.

IV, 2. Discrimination of Forms. (Kuhlman, 7 out of 10.)

TEXT AND PROCEDURE

Use the double set of geometrical figures supplied in the packet of test material. One of these should be cut out so that the several geometrical figures are separated.

Place the uncut card before the child, put the cut out figure of a circle in the position marked with a X on the uncut card and say: 'Show me one like this.' At the same time pass the finger round the circumference of the cut out circle.

'Do you see all these things?' (Simultaneously run the finger over the various forms on the uncut card.)

'And do you see this one?'

'Now, find me another one just like this.'

Take the square next, then the triangle, and then the others in any order.

Correct first error, saying, 'No, find one just like this.'

Remarks. At this level of intelligence children just begin to discriminate between different shapes of figures. This discrimination comes as a result of constant comparison and contrast of figures. The child has to see squares and circles several times and constantly compare and contrast them with one another, so that distinctive images of a square and a circle are fixed in his mind and later on he can carry in his mind these images and compare them with the actual perception of a square that is placed before him. Then only can he see the square as a square. The child who has not carried out these processes in his mind sees no difference between a square and a circle. The same thing is implied in the test of copying a square, assigned to this same year, IV, 6. Many children draw a round figure like a circle in copying a square. This results from the failure to grasp the difference in the shapes of two figures, more than failure in the practice of muscular co-ordination.[1] Similarly even with adults. The writer remembers how very difficult it was for him for a long time to distinguish between two brothers who looked alike. It was only after seeing the brothers several times and in different settings and observing the minute details of their respective features that he learnt to distinguish between them. Then he began to laugh at himself for having failed to distinguish between them when there were so many distinctive marks in their features. Similarly with children who learn to distinguish between simple figures—simple from our point of view—only after careful observation, comparison, and contrast. To distinguish between the several figures in this test it is not necessary that the child should know the names of the figures; nor is it necessary that he should know how to draw them. It is enough for the child to be able to grasp the image of the figure shown and retain it and compare it with the figures on the whole card. Sometimes this image is quickly forgotten and the child has to go back several times to the figure shown, and carry the image as many times for comparison with the figures on the card.

[1] It is true that the image of a figure may be in part kinæsthetic and that ability to grasp differences in shape may be bound up with practice in muscular co-ordination. But in the test of drawing a square it does not appear to the writer as though kinæsthetic imagery plays any important part. There is room here for further experiment.

IV, 3. Comprehension, First Degree. (2 out of 3.)

TEXT AND PROCEDURE

(*a*) 'What must you do when you are sleepy?'
(*b*) 'What ought you to do when you are cold?'
(*c*) 'What ought you to do when you are hungry?'

After waiting about 20 seconds for an answer the questions may be repeated more than once. It is most important at this age to secure attention and for this purpose it is frequently necessary that the questions should be repeated more than once.

Remarks. These are the simplest of the comprehension questions. They are again to be found in year VI, year VIII and year XII. It may be asked what makes the questions harder and harder. One answer is that the number of items woven into the situations are increasing, making the situations more and more complex and hence more and more difficult to imagine. Even in the questions of this year, by making the children call up the images of the situation the questions are made more difficult than they would be if the children were made to meet the actual situations. In such tests the sub-tests have all to be of the same difficulty. They are so in this age, but they are not exactly so in the higher ages. In the latter case there is the danger of the score of the test being determined only by the most difficult of the sub-tests. On the whole these comprehension questions are very good in that they make children think in the abstract and such thinking is a quality only of superior intelligence. In repeating the questions the formulæ may be slightly modified (as shown in brackets in the vernacular versions) because the children may not be equally familiar with the different kinds of phraseology. Questions (*a*) and (*b*) were suggested by Binet in 1905 but were not standardized. They were standardized for the first time in the Stanford revision, which also added the last one, namely (*c*).

IV, 4. Repeating Twelve to Thirteen Syllables. (1 out of 3 absolutely correct: or 2 with 1 error each.)

TEXT AND PROCEDURE

'Listen, say this: "Where is Kitty?"' (For practice only.)
'Now say this:

(*a*) "The boy's name is John. He is a very good boy."

(*b*) "When the train comes you will hear the whistle blow."
(*c*) "We are going to have a good time in the country." '

Remarks. With the test of repeating syllables as also with that of repeating digits, only one reading is allowed. After securing the attention of the child the first sub-test should be given. If the child does not respond owing to timidity or crossness repeat the same formula. But this cannot be counted for success. Then the second and the third sub-test should be given once only. Defects in pronunciation should be ignored. Binet, Burt, and Bobertag standardized a sentence, or sentences of 10 syllables and located the test in year V. But the statistics of the present study agree with Terman's in locating the test with 12 or 13 syllables in year IV.

IV, 5. Counting Four Pice

TEXT AND PROCEDURE

Place the pice on the table before the child in a horizontal row.

'See these pice. Count them and tell me how many they are. Count them with your finger this way.'

'One—' 'Now go ahead.'

'No; count them with your finger, this way.'

The test is passed only if the counting tallies with the pointing. Lastly ask, 'How many?'

Remarks. The most important thing in this test is that the child should count 'one, two, three, four' loudly, at the same time putting his finger on the pice, and that the pointing and counting should tally; and so schooling or learning to recite numbers has no effect on the ability to pass this test. It requires an intelligent interest in numbers and the child's spontaneous interest in them makes him handle things and count them. Quite a number of children who are paid great attention while being taught the numbers fail this test by not putting their finger on the pice to tally with their counting. They are slow in pointing with their finger while their lips move faster in reciting the numbers. The performance of this test requires higher mental ability than that required for mere mechanical counting of numbers. This test however does not require a full concept

of the number four on the part of children. Probably what the children know at this age is that four is more than one and two and is a fairly large number. It is also very doubtful whether the child recognizes the whole group as four or calls the last pice as 'four'. But the reply to the last question 'How many' is generally 'four'. Do not score the test plus unless the answer to this last question is correct. The procedure of this test, which is after Terman, goes a little further than Binet, who simply says, 'Count them aloud, count them with your finger.' Terman adds, 'Count them with your finger this way—one.' Binet locates the test in year V; but Burt who follows exactly the same procedure locates it in year IV.

IV, 6. Copying a Square. (1 out of 3. Pencil.)

TEXT AND PROCEDURE

Put the printed model of a square before the child and say: 'You see that.' (Point to the square.) 'I want you to make one just like it. Make it right here.' (Show where it is to be drawn.) 'Go ahead. I know you can do it nicely.'

Don't run the finger around the four sides. Give three trials, saying each time, 'Make it exactly like this.'

After the child has drawn all three, ask:

'Which one do you like best?'

Remarks. The model used should be the one supplied in the packet of test material. If another is used care should be taken to see that it is of the right size, that is about 1¼ inches on each side. It should also be drawn in thick black lines, preferably in Indian ink. The child should be asked to draw in pencil, as children of this age cannot handle a pen properly. Success in this test depends, it appears, more on the ability to distinguish between different kinds of forms than on the acquisition of muscular co-ordination. (See remarks under IV, 2, p. 124.) Children generally are found to cast a casual glance at the figure and finish off the drawing at once. Those who have not reached the mental level draw a round figure. The formation of the corners is the hardest thing in this as well as in the 'diamond' test (VII, 2). The corners drawn by immature children in the 'diamond' test are more interesting.

Only one success out of three is enough for a pass in this test. The answers should be carefully compared with the model scoring card before assessing. The square drawn should be recognizably a square but mathematical accuracy or anything near it is not required. Even with squares drawn by adults the perpendicular side will always be less than the horizontal side. This is one of the optical illusions. Note also whether the child draws the square continuously or draws the opposite sides together. Sometimes in the former case one of the corners is a little rounded off. The first trial of the child is generally the best. This proves that the task is a heavy one from the point of view of the child requiring very great effort and attention. During the second and third attempts the child, because of fatigue, cannot bring all his energy and effort to bear.

Binet requires the child to draw with pen and ink and further gives only one trial. This seems to make the test slightly more difficult. He locates it in year V. It is not however made as difficult as the unfamiliarity of the material would suggest. This proves that the most important factor for success in this test is sufficient mental development enabling discrimination between different kinds of forms.

IV, Alternative. Comparison of Two Weights. (3 out of 3: or 4 out of 5.)

TEXT AND PROCEDURE

Use the two boxes of 3 grammes and 15 grammes in weight and present them during the trials in the following order, 3—15; 15—3; 3—15; 15—3; 3—15.

'You see these blocks. They look just alike, but one of them is heavy and one is light. Try them and tell me which one is heavier.'

'Tell me which one is the heaviest.'

If the child does not know how to proceed and simply lifts any one blindly and hands it over, say,

'No, that is not the way. You must take the boxes in your hands and try them, like this.'

Show the child the proper method of weighing the boxes in the hands by taking the boxes in your own hands one after the other.

In the second trial, the weights are shuffled and their positions reversed.

In the third trial the positions are the same as in the first.

Materials. Stiff and strong cardboard pill-boxes about 1¼ inches in diameter make very good weight-boxes for this test as well as for X, 1. Five boxes of uniform size, shape and colour should be selected. They should be accurately weighed by stuffing them with lead foil and cotton until they weigh 3, 6, 9, 12, and 15 grammes respectively. The lead should be exactly in the centre of the boxes with cotton on both sides and should not be loose nor should it rattle. The lids should then be glued on permanently. The boxes should be marked underneath with distinguishing letters such as P, S, Y, C, H, so that by silently turning them over the examiner can see which is which. The child, however, should not know that they are so marked. For the test of this year use only the first and the last, i.e. 3 grammes and 15 grammes.

Remarks. If the child has reached the mental age he generally hands over the right box. Terman accepts only 2 correct responses out of 3. This leaves a good deal to chance. Hence it is better to accept 3 out of 3 or 4 out of 5, since once the child understands what is required his responses are always correct. The difference in weights of these boxes is sufficiently large to be discriminated by children of this age. Backward children are always prone to hand over the box on the right (or left) hand side. This is an instance of stereotypy to which backward children are generally prone. Success in this test seems to depend mainly on the ability to understand verbal instructions. The idea of making comparisons and selecting one of two or many is rather difficult for children below this mental level. After the instructions are understood the requirements for reaching the goal are to be kept fixed in the mind until that goal is reached. This in itself requires a tremendous expenditure of energy in the form of sustained attention. This is like lifting a heavy weight and placing it on the table. Some may succeed in doing this while others may lift the weight to three-fourths of the height and then drop it through exhaustion of the strained muscles; others still may lift it to one-fourth of the height; and lastly there may be some who may not be able to lift the weight from the ground at all. The test appears

to lie on the borders of ages IV and V, and inclines more on the side of the former. It is located in year IV in the present revision.

Burt presents the boxes of 3 grammes and 12 grammes and 6 grammes and 15 grammes alternately and gives three trials. All three trials are required to be correct. He locates the test in year V.

CHAPTER X

TESTS FOR YEAR V

V, 1. Æesthetic Comparison. (*No errors.*)

TEXT AND PROCEDURE

Present the three pairs of pictures on the card before the child one at a time, hiding the other pairs from view by means of a piece of cardboard or sheet of paper. Say,

'Which of these two pictures is the prettiest?'

Remarks. The pictures for this test are the same as Binet's; but Indian costume is substituted for European. Thus the nature of the difficulty of the test is the same as that of the original. The test is found suitable for year V as was found by Terman. Binet located it in year VI. Burt located it in year IV. This test is a very interesting test and children respond to it in a lively manner. It correlates highly with intelligence, which shows that æsthetic sense develops with intelligence. This throws doubt on the common supposition that artistic ability, which undoubtedly requires æsthetic sense, does not correlate with intelligence; that dull children often make good draughtsmen and artists. Similarly it is supposed that musical ability does not correlate with intelligence. The writer knows one or two backward children who are very good artists or singers. One boy was found in the course of testing to be backward in intelligence. His school work confirmed the same finding, but he had very good drawing and artistic ability. He could, for example, draw beautiful diagrams and pictures in his science paper, but his answers revealed that he had no clear grasp of scientific principles. Another case was that of a girl of about 8 or 9 years, who appeared very backward and could not talk, but could sing most beautifully. She could pick up any tune quickly and having heard it once or twice could sing it in proper notes without uttering the words. To the writer these stray instances appear only as exceptions. We are not likely to make a note of a hundred intelligent people who are good artists and singers but one or two dull or defective people who show high drawing or musical ability strike our imagination and we remember them and quote them as instances

of popular beliefs, which by the way must have started in the same fashion. The real thing is that an intelligent person shows his intelligence in whatever direction his energy is directed. A few dull people finding that they cannot compete with their more clever fellows in their class studies or the ordinary business of everyday life may have somehow developed a liking for these subjects and may have been concentrating their attention on them and thus stand out in relief against their fellows; but this does not disprove the general rule.

V, 2. Definitions in Terms of Use. (4 out of 6. Wait about 1 minute each time for response.)

TEXT AND PROCEDURE

Use the words: chair, bullock (or horse), spoon, doll, pencil, and blanket. Say,

'You have seen a chair. You know what a chair is. Tell me, what is a chair?'

If the child does not give a definition but says, 'that is a chair' or 'a chair is a chair', etc. say,

'Yes, but tell me; what is a chair?'

If the child is too shy or cross, coax him and repeat the same formula with the first word several times. But once the child responds never show by gesture or nod or word that the definition is not correct. Accept every definition with approval. But if the definition is very bad do not give the impression that that is the best definition, but just leave the child alone. It is not permissible, as some who are not properly initiated into the art do, to ask, 'What do you do with a spoon?'

The second word for definition is 'horse' or 'bullock'. If the child has seen horses and knows their common uses this word is to be preferred to 'bullock'. With 'bullock' the difficulty is that the child defines it very often as 'a cow'. Then it is necessary to ask the child further:

'A bullock is not a cow. Is it? Tell me what is a bullock.'

Remarks. Binet has included three tests of definitions in his scale. The first one, 'definition of familiar words in terms of use', he locates in year VI; the second one, 'definition of familiar words in terms superior to use', he locates in year IX; and the third one, 'definition of abstract words', he locates in year XII.

He has thus discovered a very ingenious way of classifying children's responses according to their mental ages. The present test is a good test and there is no difficulty in assessing it; but when we come to definitions superior to use, we find some difficulty in determining whether the definition given by any child is superior to use. We shall discuss this question later. The objects chosen are all familiar objects, so there is no question of the child's not knowing the words. The test therefore examines only the child's power of definition or his power of expression. This power of expression is a sign of intelligence. Dull children know the nature of objects, but the development of abstract language necessary to give expression to their perceptual mass is not sufficiently advanced. A good deal depends also on the actual objects chosen. If the same words used in this year are used in year VIII also, for definitions superior to use, we could not say whether we would get suitable answers, or whether if we had used the words of year VIII in year V also we would have got suitable answers for year V. It appears that some words are more suitable for use definitions and others for class definitions. Terman uses different sets of words for the two years and they are standardized for those years only. We have followed Terman in this respect. It would have been better, however, if the same set of words had been used for the two ages, as was done by Binet and Burt; but the selection of the objects would require very great care. The selection of a different set of words has one great advantage, namely, that if a child starts giving use definitions, he usually continues to do so with the rest of the words. The testing can then go on with other kinds of tests. At a later stage he is presented with new words which give him the chance of attempting class definitions. Thus a second chance is given to the child with words a little more difficult and he is obliged to do his best.

Failures are generally of the nature of silence or repetition of the same word or the reply, 'I don't know.'

V, 3. Three Commissions. (*All three correct in proper sequence.*)

TEXT AND PROCEDURE

After getting up from the chair and moving with the child to the centre of the room, say,

'Now, I want you to do something for me. Here is a key. I want you to put it on that chair over there, then I want you to shut (or open) that door, then bring me the box which you see over there (pointing in turn to the objects designated). Do you understand? Be sure to get it right. First put the key on the chair, then shut (open) the door, and then bring me the box (again pointing). Go ahead.'

Remarks. In giving out the formula read out the instructions slowly and clearly. Stress the important and key words such as 'key', 'door', 'first', 'then', etc. While the child is carrying out the directions do not stare at him. A casual look of approval is all that is required. Never indicate or suggest the order of action by word or look or gesture, nor say any such thing as 'What is the first thing to do?' or 'What next?' The execution of the triple command requires the holding fast in consciousness the three commands in their proper order and the will to carry them out as directed by the memory. If the memory of their proper order slips, either the order of performing the commands is changed or one of the commands is forgotten or the child stops in the middle of the execution. The comprehension of the serial order of things must also be a great factor in the successful performance of this test. Binet located the test in year VII in his 1911 series; but it is found quite easy for year V.

V, 4. Distinguishing Right and Left. (3 out of 3: or 5 out of 6.)

TEXT AND PROCEDURE

'Show me your right hand.'
'Show me your left ear.'
'Show me your right eye.'

If there be only one failure repeat the above formula substituting 'left' for 'right' and 'right' for 'left' in them.

Remarks. In reading the formula stress the key words 'right', 'left', 'hand', 'ear' etc., don't suggest the answer by a glance or any other gesture. Nor should the examiner repeat the question by stressing 'right' or by simply saying 'right' if the child shows the left hand (as if the one that he showed were wrong). If the child first shows the wrong limb and then corrects himself spontaneously, score him correct. Generally in such cases

the rule is that the second answer should be taken into account for scoring. Our statistics show that the test is easy enough for year V. Binet locates it in year VII in his 1911 series. Terman puts it in year VI and Burt also in the same year. Binet and Burt use only 'right hand' and 'left ear' and require both to be correct.

There is a good deal of discussion on the question of space orientation with children. It has been observed and experimentally proved that children distinguish between up and down, that is vertical distinctions in space, more readily than right and left. What is the cause of this? Several explanations are offered, any one or more of which may be responsible for this distinction. (1) The most important cause for this appears to the writer to be that in vertical distinctions the earth as the fixed ground serves as an object of reference. This object of reference is so large and firm that you cannot go to the other side of it. Thus whatever is away from it is up and whatever is nearer to it is down. In the case of right and left there is no such fixed object of reference, although in considering the two hands there is of course the body to serve as such an object. But the difficulty here is that the hands are symmetrically placed on either side of the body. The child has, therefore, to distinguish between right and left by first having to find out the special functions of the right or the left hand: for instance the right hand is used for eating. The child does writing also with the right hand, but this comes at a later stage and many children have already learnt the distinction of right and left before they begin to write. (2) Kinæsthetic memory of sensation is another explanation given. It is said that a child moves objects up and down and the memory, involved in these muscular movements, is more distinct than the kinæsthetic memory involved in distinguishing between objects to the right or left. In the latter case, it is suggested that no larger muscles of the body are involved in the distinction; at most, it may be the movements of the eyes to the right or left; but on the other hand, it may be said that these right and left movements of the eyeballs are more important than the up and down movements of the same. Some psychologists give the name of *local signature* to these distinctions in space relation made by the movements of the eyeballs. (3) The *frequency* with which a child makes distinctions between *up*

and *down*, and *right* and *left* is offered as one of the explanations. It is alleged that distinctions between up and down occur more often in a child's everyday life than those between right and left. (4) Finally, the distinction may be due to the *frequency* with which a child uses or hears the *words* in the language—up and down or right and left.

If you observe little children trying to learn right and left, and up and down distinctions it appears that they do so by the following steps: (1) They slowly distinguish between up and down by reference to the earth or ground. Anything away from it is *up*, anything close to it is *down*, or between right and left by associating certain actions of the right hand with the right hand and those of the left with the left. (2) Secondly they associate the conventional verbal names 'up' or 'down', 'left' or 'right' with these directions as indicated in the first step. In this process, the distinctions between the horizontal directions are certainly harder than those between the vertical and hence appear to evolve more slowly.

V, 5. Naming Four Coins. (3 out of 4.)

TEXT AND PROCEDURE

Use the coins, anna, pice, rupee, quarter-rupee. Place each of these coins one at a time in the above order before the child and say,

'What is that?'

If the child simply says 'money' or a 'coin' or 'copper', say further,

'Yes, but what do you call that piece of money?'

No supplementary questions are permitted.

Remarks. The test is scored on the basis of 3 out of 4. The last coin, the four-anna piece, is the hardest of the four and very few children of this age name it. So the test becomes almost one of the first three coins all three of which would be required to be answered. Binet includes this in year VII of his 1908 series, with the common French coins. Burt also uses four of the commonest English coins and requires all four to be correctly answered. He locates it in year VI. This test and some other similar tests are criticized on the score that success in them depends a good deal on instruction. But as remarked in earlier

chapters interest in knowing many similar everyday things of life depends on the intelligence of the children. A bright child is always hungering after knowledge and this is displayed by his great curiosity about things in his environment. A dull child is always inert and does not want to know the subtle differences between small coins, days of the week and so on. The correlation of this test with mental age as determined by the scale as a whole is 0.89.

V, 6. Counting Thirteen Pice. (*1 out of 2 trials, without error.*)

TEXT AND PROCEDURE

As in IV, 5.

Remarks. Binet (1911), Terman, Burt, Bobertag all agree remarkably well in locating the test in year VI. Our own statistics locate it at the upper end of year V. As in IV, 5 the counting and the pointing must tally for a pass in this test. Used in this way the test requires intelligent understanding of numbers. Mere schooling gives no advantage. For success one of two trials should be absolutely correct.

V, Alternative 1. Forenoon and Afternoon.

TEXT AND PROCEDURE

'Is it morning or afternoon?'—(in the morning).
'Is it afternoon or morning?'—(in the afternoon).

Remarks. This is one of the questions of time orientation. Does the time orientation in this case come earlier than the association of the name with the period of day, or does the time orientation result from the need to learn the meaning of the verbal names, that is in order to associate the name with the period of day? The latter alternative seems more probable. After children begin to talk, they try to learn the meaning of new words spoken to them and for this purpose they begin to distinguish between different things denoted by them. In fact language is a great help in all scientific analysis and classification.

In Indian terminology and usage the day is divided into three parts—(1) morning, from sunrise till about midday or the midday

meal; (2) midday, to about 3 o'clock or tea-time; and (3) evening, 3 o'clock to sunset. Thus the day appears to be divided more by the meals of the day than from more scientific considerations.

The first period consists of about 6 hours or two *praharas*, the second of 3 hours or one *prahara* and the third of 3 hours or one *prahara*. Scientifically it is divided into 4 parts or *praharas* each of 3 hours. Hence the questions are worded in two ways as shown above—one alternative being between morning and afternoon, and the other between morning and evening. These formulæ work very well. In assessing the answers, afternoon (*madhyânha* (*Kan.*), *dupâr* (*Mar.*)) may be taken as correct if the child has taken his midday meal though it may not be actually 12 o'clock. Time orientation hour by hour is not developed in children of this age.

One great objection raised against this test is that it gives a choice between two alternatives only and answering by mere guessing or answering at random would give 50 per cent correct answers according to the law of chance. Binet included the test in his 1908 series in year VI, but omitted it in his 1911 revision. Burt puts it in year V. Our own statistics show that it is easy enough for year V.

V, Alternative 2. Giving Family Name.

TEXT AND PROCEDURE

'What is your name?'

'What is your surname?'

If the child gives his proper name only, say,

'Yes, but what is your other name?'

'Mahadev what?'

'Is your name Mahadev Joshi?'

Remarks. This test is generally located in year III by European and American authorities. Indian children, however, are not accustomed to use their family name; neither are they ever called by their family name nor do they usually hear people calling their parents by the same. The more common method of addressing people in the household is by their proper name. Hence the test is not very suitable for children of India. If it is to be retained at all our statistics show that it should go

up to year V, and so it is retained as an alternative test in year V. Objection can also be raised against this test on the ground that the more enlightened families are in the habit of teaching their children their proper name and their family name, while in backward families even very much older children do not know their family name unless they have been sent to school and their names registered in full.

V, Alternative 3. Giving Age.

TEXT AND PROCEDURE

'How old are you?'

Remarks. This is another test that is not very suitable for Indian children, or for any children at all. In the first place the age as given by children may be either age last birthday or age next birthday. Both ways are correct; with Indian children it is more common for them to be distinguished by their age next birthday. Secondly, celebrating the birthday is not usual among Indian children. In illiterate families even adults do not know their age. Hence this test should be very sparingly used, and is retained here as an alternative test only for the sake of comparison. Binet had it in his 1908 scale in year VI, but omitted it in his 1911 series. Many other investigators have also omitted it.

CHAPTER XI

TESTS FOR YEAR VI

VI, 1. Repeating Four Digits. (1 out of 3.)

TEXT AND PROCEDURE

'Now, listen. I am going to say over some numbers and after I am through, I want you to say exactly what I say. Listen closely and get them just right.'

'4-7-3-9; 2-8-5-4; 7-2-6-1.'

Success with a series which has been re-read should not be counted.

Remarks. See remarks for III, 8 and IV, 1. The digits should be read at the rate of one every half second for the reason stated there. Though repeating digits appears a very simple test, actually it is far from being so. It puts a great strain on the mind and hence should not be given towards the end of the examination. It brings on fatigue very rapidly and should therefore be given as far as possible when the mind is fresh. Nor should testing begin with this test as children are likely to fight shy of it.

VI, 2. Comprehension, Second Degree. (2 out of 3. Time allowed ½ minute.)

TEXT AND PROCEDURE

'What's the thing to do—

(*a*) 'If it is raining when you start for school?'

(*b*) 'If you find that your house is on fire?'

(*c*) 'If you are going somewhere and miss the train? (or tram-car or motor-bus or ferry?)'

After 5 to 10 seconds repeat the question once more.

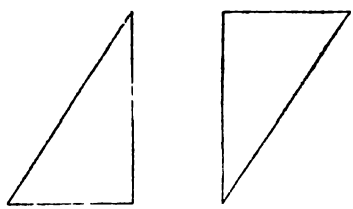
Remarks. See remarks under IV, 3. The question may be repeated a second time only. No more repetitions are allowed. Care should be taken, however, that attention is secured before the question is asked. Terman says, 'The three comprehension

questions of this group were all suggested by Binet in 1905. Only one of them however, "What should you do if you were going to some place and missed your train?" was incorporated in the 1908 or 1911 series, and this was used in year X with seven others much harder.' The other two were standardized for the first time in the Stanford revision. In this test as also in some others Terman would allow the question to be repeated once or twice. As remarked elsewhere it makes a good deal of difference whether a question is repeated once, or twice or thrice. Backward children begin to comprehend questions if they are repeated several times. We have therefore definitely laid down how many repetitions there should be in each case. In the present case the question may be repeated only once as directed above. The third question should be varied by using the conveyance most commonly in vogue at the place where the child is examined. Nowadays motor-buses ply between any two adjoining important towns several times during the day and hence this way of stating the question is very convenient. If the name of the adjoining town were put in perhaps the question would be a little easier.

VI, 3. Divided Card. (2 trials out of 3 correct. 1 minute each. Or better, thrice in 3 minutes.)

TEXT AND PROCEDURE

Select two stiff white cards each 2 in. × 3 in. Cut one of these diagonally into two triangles. Place the undivided card in front of the child with the longer side placed right and left. Below this, *a little nearer the child*, place the triangles cut out of the second card in the following position:



Then say,

'I want you to take these two pieces (touching the two triangles) and put them together so that they will look exactly like this (pointing to the uncut card).'

If the child sits silent without knowing what to do, say:

'Turn these pieces round as you like and put them together so that they look exactly like this.'

After the child has finished, ask:

'Do they look like this?'

If three trials of one minute each are given, after each trial put the pieces in the position shown and repeat the short formula:

'Put these two pieces together so that they look exactly like this.'

If during the experiment the child turns over one of the two pieces, turn it over again and start the child again, as it is impossible to get the right construction with one of the pieces turned over upside down. The trial should be regarded as having begun from this new start.

Remarks. This test was scored both ways (i) by giving one minute for each performance and requiring only 2 correct performances, out of 3, and (ii) by giving 3 minutes for 3 performances. The scoring was exactly the same in both these ways. The latter method, that of giving altogether 3 minutes for 3 performances, has a distinct advantage in not disturbing the child when he is in a contemplative mood and trying to put the pieces right. This method is similar to that of Healy and Fernald's 'construction puzzle' test which gives a total of 5 minutes for 3 performances. (See XII, 2.) It is always better therefore to take the test in this way.

The test is similar to Ebbinghaus's 'completion' test. The child has first of all to form a clear idea of the goal to be reached, and secondly, under the influence of this idea to direct his efforts to the realization of this goal. Mentally backward children fail in this test either because they cannot form a clear idea of the goal to be reached or because they fail to hold it firmly in mind until it is reached. Lastly, the child must have the power of self-criticism, by which he compares his own performance with the model and finds out whether his performance is correct. Backward children are sometimes quite satisfied with their own performance though the performance may be quite ludicrous.

Burt, strictly following Binet and Simon's instructions, presents the triangles so that the hypotenuses are at right angles, but

do not face towards each other.[1] He says Terman's method of presentation is easier; but it does not appear to be so. On the contrary a child may by chance move the upper triangle in Burt's position slightly to the right and find that he accomplishes the feat. Burt's supplementary instructions, 'move them about and see if you can fit them together', agree with ours. This supplementary formula is put in so that we may be sure that a child tries his best and does not remain idle for want of inability to understand the question as it is put in one form. Burt gives only one trial and gives a half minute to it after Bobertag.

The test is located in year V by Binet and Terman, but in year VI by Burt and Bobertag. Our own statistics agree with the latter.

VI, 4. Giving Number of Fingers. (*No error.*)

TEXT AND PROCEDURE

'How many fingers have you on one hand?'

'How many on the other hand?'

'How many on both hands together?'

Keep an eye on the child's fingers and if he is found to count them say,

'No, don't count. Tell me without counting.' Then repeat the question as before.

Remarks. In Indian nomenclature the thumbs are included in the fingers, so the difficulty of excluding the thumbs never arises. This test is harder than 'counting 13 pice' (V, 6). It requires on the part of the child a fuller concept of numbers. Unless this concept is formed the child cannot retain the memory of these numbers. The concept of numbers required for counting is decidedly lower than this concept. A certain interest in numbers has prompted the child to count his fingers probably several times and has made him remember this number. The concept of smaller numbers such as one, two, three or four seem to have been formed earlier and it would be interesting to find out at what age the child knows that he has one nose or two eyes.

[1] See, however, Kite's translation, p. 199. 'Put the two triangular pieces in front of the child in such a way that the two hypotenuses are not adjacent.'

Contrary to expectation the test is found to be a good test of intelligence as is shown by the regular rise in percentages of passes and the high correlation of the test with the scale as a whole. Coaching does not affect the test to any appreciable extent. Our statistics show that the test is easy enough for year VI. Burt assigns it to year VI also. Binet (1908) and Terman have assigned it to year VII.

VI, 5. Description of Pictures. (2 of the 3 pictures described or better. Time limit 2 minutes each.)

TEXT AND PROCEDURE

Use the pictures in the following order:

1. Railway station. 2. Reception at home. 3. Motor accident.

'What is this picture about?'

'What is this a picture of?'

'What is represented here?'

The questions may be repeated in one or the other form twice or thrice to encourage the child to answer so long as the time limit is not exceeded. Forms of questions that suggest particularly enumeration, or description, or interpretation should be avoided.

Remarks. It should be carefully noted as to what constitutes enumeration (required for age III), what description (required for age VI) and what interpretation (required for age XII). Burt says, 'replies giving a mere list of persons, objects, or details' constitute enumeration; 'phrases indicating actions or characteristics' constitute description; and 'replies going beyond what is actually visible in the picture, and mentioning the situation or emotion it suggests' constitute interpretation. Sometimes replies are such as make it difficult to decide whether they constitute enumeration or description. For example: 'Here is a man', or 'He has an umbrella in his hand'. These responses should be scored minus rather than plus for this age because they show only what is present in the picture and do not tell anything about the 'actions or the characteristics' of the figures in the picture. The following answers would be plus: 'The man is going with an umbrella in his hand'; 'This man has caught hold of this man'.

The pictures selected for this test are taken from *Manoranjan*, a high class Marathi magazine depicting Indian life. They are selected from among a large number after careful testing as to their suitability and are used by courtesy of the proprietors, *Manoranjan*, Bombay. The pictures must contain a sufficient number of familiar objects, animals, and men, easily recognizable by small children; secondly, they should also show certain actions which can be easily described; and lastly, they should contain only one theme which can be properly interpreted by carefully observing the different parts of the pictures and their relations to one another. The pictures selected were found to satisfy very well all these conditions. Burt's or Terman's pictures could not be used as they depict western life. Thus though the test is materially changed statistics of the present investigation show that they are almost of the same difficulty and serve the purpose of the three tests—enumeration, description and interpretation—equally well.

This test shows very well the height of Binet's genius in evaluating children's answers. After studying these answers carefully he discerned clearly that about the age of three children can only recognize and name objects in pictures; about the age of six or seven children begin to recognize objects and their relations to one another so as to understand their mere outwardly visible actions; and about the age of twelve or fifteen their associative powers are so far developed that they can put together and combine the several parts of a picture in such a way as to find the inner purport of the picture. This ability manifests the highly synthetic powers of the mind. The test is located in year VII by Binet, Terman and Bobertag and in year VI by Burt.

VI, 6. Missing Features. (*3 out of 4. Time limit* $\frac{1}{2}$ *minute.*)

TEXT AND PROCEDURE

'There is something wrong with this face. It is not all there. Part of it is left out. Look carefully and tell me, what part of the face is not there?'

If the child speaks of parts that are not drawn in the picture such as the body or the legs, say,

'No; I am talking about the face. Look again and tell me what is left out of the face?'

In case of failure, say,

'See, the eye is gone.'

Then with the next picture, say,

'What is left out of this face?'

With picture (d) which is different from the others, say,

'What is left out of this *picture*?'

Remarks. As a rule children answer these questions promptly. The time limit is set down only as a guide in the case of children who sit silent so that after the lapse of the specified time the examiner may proceed to the next question. It is interesting to note that sometimes the children say, 'the other eye', or 'the other ear'.

This is one type of 'completion' test, in which the child is required to call up before his mind an image of an object that he has already seen and with which he is quite familiar and compare it with the present picture to find out the missing part. Other examples of such tests are filling in gaps in sentences having meaning, making up a picture out of its parts, and rearranging a disarranged sentence.

The features of the pictures in this test are all truly Binet's, but they are all Indianized by giving them Indian form of hair-dressing, Indian ornaments and dress. The results are therefore strictly comparable with Binet's. Only in the case of the fourth picture which showed the whole human figure a good deal of change was inevitable. Still the picture has served the purpose in hand very well.

In Marathi unfortunately there is only one word for mouth and face. So the formula of the question becomes a little unsuitable. But this can be avoided to some extent by using both the alternative forms of the word as shown in the Marathi text. This procedure is found to answer the purpose very well.

VI, Alternative. Naming Colours. (No errors.)

TEXT AND PROCEDURE

Point to the colours in the order red, yellow, blue, green.

'What is the name of that colour?'

Sometimes the blue colour is named purple and with a good deal of plausibility. In this case have ready some purple paper

and ask the child what colour it is; and then ask him the name of the blue colour. In all other cases no second attempts are allowed.

Remarks. The test of naming colours is more difficult than the test of recognizing colours. As a rule, children recognize things first and then learn to associate the name with the things. Thus pointing to parts of the body is easier than naming these parts. In the case of colours the recognizing and discriminating between colours is itself a hard task quite unlike discriminating between forms of familiar objects. Thus the test is hard enough for year VI, while the test of 'naming familiar objects' comes in year III. The conception of colour in the abstract, apart from the objects, is very difficult. Hence children take such a long time to recognize colours.

There is a good deal of divergence in the location of this test. Binet locates it in year VII in his 1911 revision, Bobertag and Saffiotti in year VIII, while Terman and Burt locate it in year V. Our statistics put it in year VI.

CHAPTER XII

TESTS FOR YEAR VII

VII, 1. Repeating Sixteen to Eighteen Syllables. (1 out of 3 absolutely correct: or 2 with one error each.)

TEXT AND PROCEDURE

'Now, listen. I am going to say something and after I am through I want you to say it over just like I do. Understand? Listen carefully and be sure to say exactly what I say.'

After this, read these sentences slowly, emphatically and so as to convey the meaning clearly.

(*a*) 'We will go out for a long walk. Please give me my pretty straw hat.' [1]

(*b*) 'We are having a fine time. We found a little mouse in the trap.'

(*c*) 'Walter had a fine time on his holiday. He went fishing every day.'

After each response say, 'Did you get it right?'

Remarks. This test is one of repeating syllables having sense as distinct from nonsense syllables. The number of nonsense syllables that a child of the same age can give is much less. However, the syllables are to be given exactly in the same order and accurately. Mispronunciations due to tender age may be disregarded. Any transposition, omission, or addition of syllables is therefore an error. Burt following Binet (1908) closely has only one sentence with 16 syllables and allows no error. Terman modifies this test by giving 3 chances with 16 to 18 syllables and requires one to be given correctly or two with one error each. The difficulty in both procedures seems to be very nearly the same. We have followed Terman. Our statistics show that the test is a little too difficult for year VI, but quite easy for year VII. We have located it in year VII. In the Indian languages the syllables are written in the form of letters. Hence we name the test as 'giving 16 to 18 letters' in the vernacular.

[1] In rendering these sentences into the Indian languages some changes are made in the meaning, but the requirements of the test are satisfied.

In all such memory tests the set of syllables or digits is to be read only once after securing the attention of the child. So responses obtained after a second reading are invalid and should not be counted. Below the level of the sixth year of age, however, it is very difficult to secure the attention of the child. Hence re-reading was allowed with the first set, but this was not counted and later sets were given only once.

VII, 2. Copying a Diamond. (*2 out of 3.*)

TEXT AND PROCEDURE

Place the model printed on the card before the child with the longer diagonal pointing directly towards him. If a copy is to be made by hand it should be done in Indian ink with sufficiently thick lines. The longer diagonal should be three inches and the shorter one an inch and a half.

Give him pen, ink and paper and say,

'I want you to draw one exactly like this.'

Give three trials. As the child is drawing remind him with, 'Make it exactly like this one.' But do not pass the finger around the edge of the model.

After each drawing is finished ask the child encouragingly, 'Is it good?'

At the end ask,

'Which one is the best?'

Remarks. Score the diagram plus if it is recognizably a rhombus. The vertical diagonal must be longer than the horizontal. For guidance in scoring refer to the printed scoring card, which is made up of the actual responses of children. For a pass two of three drawings should be satisfactory. Until we actually observe children of this age making these drawings, the test appears to us to be too easy. But it is very interesting to observe children making the drawings. It is really a very heavy mental burden to children of this age. Some fail to make the angles, and instead of trying to make convex angles many of them try to make them concave or re-entrant. Some, not knowing how to make a bend at the angles, make circles and others irregular turns. Others again not being able to make the angles sufficiently bent, fail to make the last ends of the lines

meet together and thus are either forced to join the gap by an additional line or to leave the gap open. The test, therefore, requires the child to form a mental image of the diagram as he would make it and then to guide his fingers under the influence of this projected image. A glance at the unsatisfactory drawings will make this clear. This is a very good test and ordinary training in schools seems to affect it but little. Binet (1911) and Burt locate it in year VI, Terman and Bobertag in year VII, and Saffiotti in year VIII. Our own statistics warrant its inclusion in year VII.

VII, 3. Repeating Three Digits Reversed. (1 out of 3. Read one per second.)

TEXT AND PROCEDURE

'Listen carefully, I am going to read some numbers now, but this time I want you to say them backwards. For example, if I should say 1, 2, 3 you should say 3, 2, 1. Do you understand?

'Ready now, listen carefully, and be sure to say the numbers backwards.

'2-8-3; 4-2-7; 9-5-8.'

If the child repeats the digits forwards instead of backwards repeat the instructions emphasizing the word 'backwards'.

Remarks. This is the first test of 'repeating digits backwards'. At this age children are often found unable to comprehend what is meant by reverse order though it is made clear by an illustration. It is very interesting to find that several children give the digits in the reverse order first arranging them in the descending order. For example, the above series are given back as 8-3-2, and 7-4-2 and 9-8-5. However, in later years the test of repeating digits in the reverse order works as a better test than the one of repeating digits in the forward order, because the child has to fix the order of the digits firmly in his mind and then reverse them. This requires quite a feat of intelligence. It is not known how many children retain the memory by auditory images, how many by visual images and how many by motor images. Literate and intelligent pupils are sometimes seen to make finger movements tracing the digits in an effort to remember. This method certainly comes to the aid of their auditory

images. It affords us also a great lesson in educational method, showing us that we should make use wherever possible of kinæsthetic imagery along with auditory and visual, and that it is also very important to establish such kinæsthetic imagery.

VII, 4. Naming Days of Week. (*Order correct. 15 seconds. 2 out of 3 checks correct.*)

TEXT AND PROCEDURE

'You know the days of the week, do you not? Name the days of the week for me.'

If the child has not comprehended what is wanted and gives irrelevant answers, say again,

'No; that is not what I mean. I want you to name the days of the week.'

After the child has finished, check up by asking,

'What day comes before Tuesday?'

'What day comes before Thursday?'

'What day comes before Friday?'

Remarks. This is one of the tests of time orientation. It is very interesting to note how the sense of time develops in children. They begin to distinguish between different parts of the day about the fifth year (see V, alt. 1), days of the week and the month about the seventh year (see VII, 4 and VII, alt. 1), and months as parts of a year and the year about the tenth year (see X, alt. 2).

The criticisms levelled against this test are that children give the names of days mechanically without having developed the necessary sense of time, and that the usual training in school or in enlightened homes makes the children learn the names of the days of the week mechanically, thus placing them in an advantageous position in comparison with other children of illiterate homes or poor surroundings. These criticisms are to a large extent removed by Terman's device of introducing checks. But it was found in the present study that children who could give the names of days of the week could also answer correctly the checks with very few exceptions. Keep record of the time from the moment the child names the first day.

The test was located by Binet (1908) in year IX, but was dropped by him in his 1911 revision. Terman locates it in

year VII, Burt in year VI and Bobertag in year VIII. Burt strictly following Binet has no checks in his test, but requires the days to be given in 10 seconds.

VII, 5. Counting Backwards Twenty to One. (40 seconds. 1 error allowed.)

TEXT AND PROCEDURE

'You can count the numbers from 1 to 20, can you not? Now count them for me.'

When the child has finished, say: 'Now count them backwards, like this, 20-19-18 and so on. Now go ahead.'

If the child says he cannot count backwards encourage him and say: 'I know you can count them backwards very well. Go on.'

Remarks. Binet wants the children to count down to 0. But it appears that this was not insisted upon, for children have no idea of zero and cannot count down to zero. All subsequent investigators rightly require counting from 20 to 1 only. Terman allows a maximum of 40 seconds for this test, and we have retained this time limit. Fifty per cent of children of mental age between seven and eight years pass this test, of whom about 35 per cent accomplish the performance within 20 seconds. In order to make the instructions quite clear without much worry it is better to follow the procedure of Dr Simon and make the child count forwards first and then backwards. Backward children count a few numbers backwards and then go on counting forwards. If the child has been specifically taught in school to count backwards, it is better not to give him this test.

To pass the test the child is required to be familiar with the numbers and with their concepts so that each succeeding number becomes familiar to him as greater by one than the previous number. Further the child has to keep constantly before his mind the object to be achieved, namely counting backwards and at the same time keep in mind the number that is uttered and imagine the number that is to come next. This requires a good deal of abstract number imagery. If the attentive attitude becomes slack at any moment the child immediately begins to count forwards as a result of the habit of counting forwards that has become automatic with him.

VII, 6. Giving Differences from Memory. (2 out of 3. 1 minute each.)

TEXT AND PROCEDURE

'What is the difference between a fly and a butterfly?'

If the child is found not to understand this, proceed:

'You know flies, do you not? You have seen flies? And you know the butterflies? Now, tell me the difference between a fly and a butterfly.'

'In what way are these different?'

Similarly, stone and potato; wood and glass. No supplementary questions are allowed as they may serve as leading or suggestive questions.

If the child says one is bigger or harder than the other, ask, 'Which is bigger (or harder)?'

Remarks. This is a very good test of intelligence. It throws the child on his own resources and mental equipment. The child has first to call up the images of the objects and then compare and contrast them in the abstract. These are the highest types of conceptual processes. We acquire and accumulate all our knowledge by means of the dual associative powers of noting differences and similarities. Our classification of matter and life into species and genera is based on this principle. An intelligent child of this mental age has therefore learnt to distinguish between common things by noting the differences. Of course the faculty of noting more minute differences develops with further acquisition of knowledge and the exercise of the mind in that direction. A botanist will find in two specimens minute differences which will be quite invisible to laymen. The differences between the common objects picked out for this test can be given by normal seven year old children.

To pass this test at this age any real difference noted, however trivial, is quite sufficient. Statistics show that the power of finding similarities between common things (IX, 3) is harder than the power of finding differences (VII, 6). In assessing the answers notice the tendency on the part of children to stereotypy. Starting, for example, by saying that a butterfly is white and a fly is black the child continues to give the same difference in the case of other pairs. Though the differential characteristics

may be true of all the pairs such answers should be scored minus. Weak minds after finding out one kind of difference are exhausted and proceed without thinking to apply the same difference to all the others.

Binet (1911) and Bobertag locate the test in year VIII. Our statistics agree with those of Terman and Burt in locating it in year VII.

VII, Alternative. Giving Day of Week and Day of Month. (*Both correct, the second within 3 days of the actual date.*)

TEXT AND PROCEDURE

(*a*) 'What day of the week is today?'

(*b*) 'What day of the month is it?'

In the latter case if the boy says he does not know, say, 'Give it roughly.'

Remarks. Before using Binet's test of 'giving day and date' it was considered whether it would be advisable to score the responses to the questions on the Indian method of giving the names of months and days. But a little experience of testing with children showed that they knew the European names of months and the date better than the Indian. The Indian months are lunar months and the counting of the days of the month stops at the end of the bright half and the counting is done again in the dark half of the month, so that there are only fifteen days coming twice in a month. As this method of counting days is not used in daily transactions, children are not so conversant with it. On the contrary in all transactions and in school they use the date, the name of the month and year according to the Christian calendar. Hence they were found to be quite familiar with these.

It was found, however, that the day of the week and day of the month were known much earlier than the name of the month and the year. So if all the four are lumped together the test, as we have remarked elsewhere, becomes practically a test of giving the two latter only. It was thus thought advisable to split it up into two parts—the day of the week and day of the month going in year VII and the name of the month and the year going in year X, the test of year VII lying on the borders of year VII and year VIII in point of hardness.

Requiring all the four items Binet and Burt put the test in year VIII and Terman with the same items in year IX. Burt gives the order of difficulty (so that the later ones are more and more difficult) as (1) day of the week, (2) month, (3) year and (4) day of the month. Our statistics put it as (1) day of week, (2) day of month, (3) year and (4) month.

TESTS FOR YEAR VIII

VIII, 1. Finding Value of Coins. (15 seconds.)

TEXT AND PROCEDURE

Arrange three one-anna pieces and three two-anna pieces, all nickel coins, on the table before the child thus: 1, 1, 1, 2, 2, 2. Then say,

'You know this?' (pointing to the anna piece).

'And you know this?' (pointing to the two-anna piece).

'Now tell me how much the value of all these coins is.'

Remarks. This test is exactly parallel to Binet's test. The coins are similar to the French coins of sous and double-sous. American investigators have used stamps as they have no similar coins in America. The test with stamps is harder than the one with coins. Burt uses pennies and half-pennies, but this makes the calculation fractional and might be a little harder. He assigns the test, however, to year VII. Our statistics show that it is a little too hard for year VII, but easy enough for year VIII, and we have, therefore, assigned it to this year. This is one of the best tests. It is so easy to give and to score. It does not depend to any great extent on school instruction, nor do children of superior homes get advantage over those of inferior homes, since all children have almost equal opportunities of handling these coins.

VIII, 2. Repeating Five Digits. (1 out of 3. Read 1 per second.)

TEXT AND PROCEDURE

Secure the child's attention and read the following series to the child distinctly and at a uniform speed of about one per second. Avoid sing-song ways of reading. Re-reading any of the series is not allowed above the level of seven years of age. Below the level of seven years, children are fidgety and the greatest problem is to secure their attention. Hence re-reading

was allowed in their case only with the first series; but such success was not counted.

3-1-7-5-9; 4-2-8-3-5; 9-8-1-7-6.

Remarks. In giving these 'digit' tests the examiner should begin with the series one step below the one suited to the mental age of the child and then the higher series. This provides just a little practice but removes the effects of fatigue. Later on as the examination continues the higher tests of digits should be given as they come in among the age series of tests. Burt differs in this and gives the 'digit' tests all together, and this gives a good deal of practice, but at the same time produces fatigue very quickly. It is difficult to say which of these causes influences the results most. Further, presumably if a child fails with five digits and by chance succeeds with one of the series of six digits, he would be taken as having succeeded with five. On the whole on looking to the location of these 'digit' tests by Burt and comparing the same with that of others, it appears that by his procedure the tests have been rather too easy for children. Burt also gives the digits at the rate of one every half second. Terman advises giving one every second. The best method and one that works well is to give them at the rate of one every half second below the level of seven years of age and at the rate of one every second above this level. If they are given at the rate of one every second below the level of seven years the children begin to repeat the digits before the examiner finishes giving them.

Psychologically the test of giving digits lies between that of giving nonsense syllables and that of giving sense syllables. Sense syllables in sentences having meaning have a good many associations and are held together in a *gestalt* by the meaning of the whole sentence. Digits have some meaning and as such can be retained better than absolutely nonsense syllables. At any age, roughly four times the number of sense syllables can be given as the number of digits. In this connexion it should be borne in mind that some of the digits are made of more than one syllable. This is particularly so in the Kannada language as contrasted with the Marathi. In Kannada, out of the digits from 1 to 10, two are of three syllables each and eight of two syllables each. In Marathi on the contrary, owing to the fact that the last syllable in this language is not usually emphasized,

two of these become practically of two syllables each and eight of one syllable each. Thus as regards the number of syllables the Marathi digits resemble the English digits, while in Kannada the difficulty is much greater. But statistics show that the number of syllables does not much affect the number of digits given. This is one more argument in favour of our assertion that the meaning of language is more important in psychological associations than the empty shell of sound syllables.

VIII, 3. Comprehension, Third Degree. (2 out of 3. Read once. After 5 to 10 seconds read a second time and then allow 30 seconds more.)

TEXT AND PROCEDURE

(*a*) 'What's the thing for you to do when you have broken something which belongs to someone else?'

(*b*) 'What's the thing for you to do when you are on your way to school and notice that you are in danger of being late?'

(*c*) 'What's the thing for you to do if a playmate hits you without meaning to do so?'

When repeating the question its form must not on any account be changed.

Remarks. The 'comprehension' as well as some other tests have not been properly timed, nor is the rule as to the limitation of repetitions of the question scrupulously observed in some previous revisions. Terman says the question may be repeated once or twice. Burt says repeat once if necessary, and twenty seconds are usually allowed to elapse although the directions seem to be that one should not be too pedantic over the time limit. It is a matter of experience that a good deal of difference is made by repeating a question once or twice or three times, more particularly a comprehension question. Backward children who fail to comprehend a question when read once or even twice, may begin to comprehend the same when read a third time. To avoid all such vagueness the procedure is made more exact in the present revision. Only one repetition is allowed and that from five to ten seconds after the first reading. After the second reading a maximum of thirty seconds is allowed for the reply. A great many children, of course, answer the

comprehension questions promptly, but a few dull children take too long and so the time limit helps the examiner to determine when to proceed to the next question without loss of time.

Questions (*a*) and (*c*) were included by Binet in the easy series located in year IX and question (*b*) is from his difficult series located by him in year X. Terman rightly grouped these three together and located them in year VIII. For reasons already sufficiently explained, it is no use grouping together very easy and very difficult questions, because the score is then determined by the hardest questions, the easiest questions serving no purpose in the group, and so it is essential that the easier and the more difficult sub-tests should be separated, grouped severally, and re-assigned to the proper ages.

VIII, 4. Definitions, Superior to Use. (2 out of 4. 1 minute each.)

TEXT AND PROCEDURE

(*a*) 'What is a balloon?'
(*b*) 'What is a tiger?'
(*c*) 'What is a football (or a ball)?'
(*d*) 'What is a soldier?'

Use the word 'ball' instead of 'football' more generally with girls, since some of them are unfamiliar with the latter.

Remarks. This is the hardest test to score in all Binet's series of tests. After studying the definitions of objects given by children, Binet came to the conclusion that children of the mental level of about six years define objects in terms of their use and those of about nine years define them in terms of description or genus. This classification of responses is quite good so far as broad principles go, but when we come to actual details a number of difficulties arises and different investigators have classified the responses in different categories. We shall first of all point out the nature of the two classifications and then discuss a few examples.

A. *Definitions by use.*

Use[1] includes (1) action or functional use; and (2) use for us.

[1] Cyril Burt, *Mental and Scholastic Tests*, p. 42.

, Examples of (1): it goes up (for balloon); it eats us (for tiger); it bounces (for football); he carries a gun (for soldier),

Examples of (2): to sit in (for balloon); it is in a circus (for tiger); to kick (for football); he keeps watch (for soldier or policeman).

B. *Definitions, superior to use.*

These include (1) description of shape, size, colour, material of which it is composed, actions, etc.; and (2) higher class or genus, with some kind of differentia.

Examples of (1): it is like a motor-car (for balloon); it has stripes on it (for tiger); it is of leather (for football); he carries a gun, he wears a kind of cap (for soldier).

Or again: it goes high up, men sit in it (for balloon); it is in the forest, it eats people (for tiger); boys kick it, it goes up (for football); he carries a gun, he catches thieves (for policeman).

Examples of (2): it is a kind of motor-car; or, it is a car that goes up in the air (for balloon), (both are correct definitions; but 'a car', particularly as it is given in the Indian language without any qualifying word, is incorrect); it is an animal that eats people, or, it is a kind of animal (for tiger); it is a big ball, or, it is a kind of ball (for football) (simply 'a ball' is incorrect); he is a man who catches thieves (for policeman).

A number of observations require to be made on this test. In the first place Binet uses the same words for both the ages—VI and IX. Perhaps this was a better method from the point of view of pure psychological investigation. Terman, however, departs from this procedure and uses words which more generally evoke use definitions in year V and other words which more generally evoke description or classificatory definitions in year VIII. We have generally followed Terman. Whatever the words selected, when once they have been thoroughly standardized, they can be safely used. Besides, Terman's method would seem to avoid some ambiguous responses.

Secondly, other investigators have classified definitions by actions as belonging to the lower mental level. On carefully studying the responses in the present investigation it was found that quite a large number of intelligent children, even much above the mental level of eight years to which the higher type of responses belong, define objects in terms of actions more than

one. Hence it was thought that when an object was defined in terms of only one action, it belonged to the mental level of five years, but when it was defined in terms of more than one action, it was regarded as a descriptive definition and assigned to year VIII. This latter type of definition proceeds from the desire of the mind which, not being satisfied with only one action, proceeds to give more actions than one, which greatly restrict the application (the denotation) of the definition. To restrict the application of the definition to a smaller class of objects is analogous to giving the genus and then the differentia.

Thirdly, definitions by genus without any kind of differentia or a qualifying word have been scored minus. Children even of low intelligence give definitions in terms of genus without a qualifying word. For example, they say, 'a football is a ball'. This is minus for the higher age. On the contrary if a child says 'a football is a *kind* of ball', he passes in the higher test. It is almost as good a definition as 'a football is a big ball'. It proceeds from the desire of the mind to restrict the application of the word 'ball' to a smaller class of objects by adding 'a kind of'.

VIII, 5. Naming Six Coins. (No error. Give in order indicated anna, pice, rupee, quarter-rupee, half-rupee, two-anna piece.)

TEXT AND PROCEDURE

Procedure same as in V, 5.

Remarks. Binet and Burt (following Binet closely) use nine coins and locate the test in year IX. A good many other investigators do the same and locate the test in year IX or X. Terman, however, uses only six coins and locates it in year VIII. Our statistics with the six Indian coins go to show that the test is suitable for year VIII, but it should be observed here that as the two-anna piece is the hardest of all and as no error is allowed in the test, the test becomes a test of only one coin, namely the two-anna piece. The quarter-rupee and two-anna piece are current both as silver and nickel coins. Silver coins should be used first and if any one of these is found to be unfamiliar the nickel coins may be shown. The quarter-rupee and two-anna piece should be named as 'four annas' or 'four-anna piece' and 'two annas' or 'two-anna piece'. It is not enough to give the

names as 'pavali' and 'chavali'. These names themselves are vaguely remembered by children and very often they are transposed, and no reliance should therefore be placed on these responses.

VIII, 6. Reading and Report. (*2 facts: 10 errors: 2 minutes.*)

TEXT AND PROCEDURE

The following is Binet's selection as adapted by Terman, with necessary changes as required to suit local conditions:

Bombay,/September 5th./A fire/last night/burned/three houses/ near the centre/of the city./ It took some time/to put it out./ The loss was fifty thousand rupees,/ and seventeen families/lost their homes./ In saving/a girl/who was asleep/in bed/a fireman/was burned/on the hands./

Put the above passage, printed without the bars on the card contained in the packet of the test material, before the child and say,

'I want you to read this for me as nicely as you can.'

Ask the child to read aloud and help him in case he cannot read any individual words, counting these as errors.

Carefully record the number of errors made and the time taken. It is convenient to use a stop-watch in all cases where time is to be carefully recorded. If one is not available have at least a watch with a seconds hand. When the child has finished say,

'Very well done. Now, I want you to tell me what you read. Begin at the beginning and tell me everything you can remember.'

If the child stops after saying a few words, say further,

'And what else? Can you remember any more of it?'

If the child misunderstands and thinks that the passage is to be given word for word, say,

'Tell me in your own words all you can remember of it.'

Don't ask any supplementary questions. Only urge him on encouragingly so that he tries his utmost.

Remarks. It is essential that the child's response should be taken down verbatim. This is a difficult task but it can be done with a little practice if only the first letter of every word is written down as the child talks and then completed after

the child has finished. In scoring for memories it is enough if the ideas are correctly reproduced. The exact words are not required. The passage as given above divided by means of bars is a great help in scoring. After the child's response is taken down underline the memories and then count.

It will be noticed that this test occurs in years VIII, IX and X with different scores. So according to our general rule it should be scored in the highest year, the conditions of which are satisfied by the child's responses, and should therefore not be made use of for other ages. The same thing applies to the 'vocabulary' test or the 'free association' test. In the eighth year the child has no great mastery over reading, and so he should be allowed two minutes for reading with not more than ten errors. This standard is determined from the actual responses of children. It should be observed that as the child advances mentally he makes fewer mistakes, takes less time to read and remembers more facts. It may then be asked why it is necessary to lay down all the three conditions. It is always safer to impose all these conditions, because a child of low intelligence by a good deal of coaching may learn to read well, but it is less likely that he will remember the required number of facts. If, on the contrary, the time limit is not set, some children may read very slowly or even twice over and so be able to remember more facts. In fact the valuable factors both of speed and accuracy are beautifully employed in this test. The test, however, should be omitted in the case of children who have not been taught reading or who have not attended school for at least two years.

Burt says that Binet purposely sets no time limit as speed of reading depends on school practice. He concurs with Binet in giving the following as the average time of reading:

At 8 years, 45 seconds.
At 9 years, 40 seconds.
At 10 years, 30 seconds.
At 11 years, 25 seconds.

It should be remembered that these are the *average* times and the time *limit* should therefore be much higher than this. Terman allows 35 seconds in year X. The passage in English contains only 68 syllables, while that in Kannada contains 134 syllables and the one in Marathi 116 syllables. The number of facts is

kept the same as in the original, namely 20. We have, therefore, set down the following as the time limits:

In the 8th year, 2 minutes.
In the 9th year, 1 minute.
In the 10th year, 40 seconds.

The actual average times of reading were:

In the 8th year (i.e. at average age $7\frac{1}{2}$ years), 55 seconds.
In the 9th year (i.e. at $8\frac{1}{2}$ years), 53 seconds.
In the 10th year (i.e. at $9\frac{1}{2}$ years), 41 seconds.
In the 11th year (i.e. at $10\frac{1}{2}$ years), 40 seconds.

A few words about the psychological importance of reading are necessary here. Many critics say that children should not be unnecessarily penalized if for want of opportunities they are unable to read. There is certainly a good deal of truth in this but only up to a certain limit. Even when children are given sufficient opportunities, as in the case of all children regularly attending school, it has been found by actual experiment that there is a good deal of difference between different children in their ability to read. Intelligent children certainly read much better and with better understanding.

In fact good reading does not depend merely on ability to recognize the letters, as the letters are inconspicuous in such continuous reading. The same is true to a lesser extent even with words. It is the ideas conveyed by the words, the meaning of the passage, that is grasped by the mind. It is doubtful whether the complete images evoked by the words stand forth in every intelligent reading or hearing. But it is possible that these images remain in the background as in a subconscious world and are associated with the meaning as a whole which runs smoothly and swiftly in the conscious world of our mind. The reading of a backward child is therefore lacking in spirit and meaningless, because the child's mental imagery is so poor that the letters or words that the child reads cannot evoke any meaning in his mind. The letters and words are to the child as so many meaningless syllables. His reading would resemble the reading of nonsense syllables by an intelligent child or adult. Further, language development means ability to think in the abstract with the aid of language signs as vehicles of thought. And this ability to think in the abstract is one of the best signs

of superior intelligence. These considerations fully justify our retention of this test as a test of intelligence, with the safeguards we have provided.

VIII, Alternative. 1. Tying a Slip-knot. (*Model kept before the child. A spare thong. 2 minutes.*)

TEXT AND PROCEDURE

Use round leather thongs such as those used for football covers. Make the knot ready in advance of the experiment and show only the completed knot. The loop should be sufficiently large and the knot loose so that the turns of the thong may be easily seen. Say,

'You know what kind of knot this is, don't you? It is a slip-knot. I want you now to take this other thong and tie the same kind of knot round my wrist.'

At the same time give the other thong into the hands of the child and present your wrist before him. The completed slip-knot should be kept on the table before the child with the loop turned away from him. The child might inspect the knot by taking it in his hand. The standing part should be sufficiently long. Let the child actually try the knot. In the knot made by the child, the standing part is sometimes smaller than the other end. Score this plus if the knot is otherwise all right. After the child finishes, whether the knot is correct or not, ask him,

'Is it exactly like this one?'

If it is incorrect he may correct it if the time limit is not exceeded.

Remarks. As Indian children were quite unfamiliar with the bow-knot, it was thought that the test would be found unsuitable in their case and an attempt was made to substitute a similar test familiar to them and equally difficult. The slip-knot was ultimately selected. This knot is generally used by Indians to tie copper ghadas to the ends of ropes used in drawing water from wells. But children of seven and eight years were actually found to be unacquainted with this knot. They invariably fell to examining the model carefully and imitating its loops in tying the new knot. In doing this they sometimes took much more than two minutes, which is too long, as the maximum time allowed is only two minutes. This seemed therefore to

test the real intelligence of children more than it would have done, had the children had previous acquaintance with the knot. The test showed a steady increase in the percentage of passes as the age increased, but the correlation of the test with mental age as determined by the scale as a whole was rather low, being 0.55. The test is put down as an alternative test in year VIII.

VIII, Alternative 2. Ball and Field. (Score 2, that is inferior plan.)

TEXT AND PROCEDURE

Draw a circle about $2\frac{1}{2}$ inches in diameter, leaving a small gap in the side next the child. This can best be done by cutting out a circle of the required size out of a thick card, and passing a red or blue pencil round the margin leaving a gap of required width. The circular line drawn should be of sufficient thickness.

Then say,

'Let us suppose that your playing ball has been lost in this round field. You have no idea what part of the field it is in. You don't know what direction it came from, how it got there, or with what force it came. All you know is that the ball is lost somewhere in the field. Now, take this pencil and mark out a path to show me how you would hunt for the ball so as to be sure not to miss it. Begin at the gate and show me what path you would take.'

Adhere strictly to this wording. In particular avoid using a word like 'around' which might suggest a circular path to be traced.

If the child simply points the path with his finger, say,

'No; you must mark out your path with the pencil so that I can see it plainly.'

Sometimes the child stops after tracing a bit of the path and might say or think the ball is there. Then say,

'But suppose you have not found it yet. Which direction would you go next?' This last formula will have to be repeated several times.

After the child has finished see if any plan governs his drawing. The drawing is scored for two ages, the eighth and the fourteenth.

Requirements for year VIII. Some sort of plan should be evidenced in the drawing though perhaps not fully suited to

serve logical purposes. If there be no sort of plan at all the performance is a failure. For example, mere random lines which may cross or re-cross one another or a single straight line or curved line are failures. On the contrary if there be some attempt to make a search by some sort of zig-zag lines, or lines on the 'wheel plan', that is radiating from the centre of the circle towards the circumference, or on the 'fan plan' that is spreading out like a fan usually from the gate and so on, the attempt counts plus. In all these plans, which are plus for year VIII but not for year XIV the path traced is usually not continuous and the lines are not parallel.

Requirements for year XIV. If the line is continuous and parallel so that no big gaps are anywhere left unsearched the plan is plus for year XIV. The following are such typical plans as given by Terman:[1]

1. A very nearly perfect spiral usually beginning at the gate or the centre of the field.
2. Concentric circles. (In this case the circles need not be joined together.)
3. Transverse parallel lines going from side to side joined at the ends.

The printed scoring card will be an aid in assessing the plans.

Remarks. This test is one added by Terman in the Stanford revision. One does not feel quite at ease in administering the test. In the first place the children cannot realize that the map drawn is that of a very big field. They do not find the necessity of going round. They seem to think that they can stand in one place and look all round for the ball. Secondly, often it is very difficult to see if there is any plan in the drawing of the child. Sometimes even an intelligent child takes a wrong direction and fails in his plan. The first impulse of a child on seeing the map of the field is to close the gap with his pencil. This is a common characteristic of the mind, which likes to complete what is left unfinished. Every gap even in acquired knowledge has to be filled in. We have placed the test as an alternative one in year VIII, and as one of the regular ones in year XIV. The correlation of the test as used for year VIII with mental age is 0.71 and as used for year XIV it is 0.66.

[1] Terman, *The Measurement of Intelligence*, p. 212.

CHAPTER XIV

TESTS FOR YEAR IX

IX, 1. Repeating Four Digits Reversed. (1 out of 3. Read one per second.)

TEXT AND PROCEDURE

The series are: 6-5-2-8; 4-9-3-7; 3-6-2-9.
Procedure same as in VII, 3.

IX, 2. Making Change. (2 out of 3 correct. 15 seconds each. Read only once again if required.)

TEXT AND PROCEDURE

Give the problems orally in the following order:

(*a*) 'If I were to buy 4 rupees worth of cloth, and should give the shop-keeper 10 rupees, how much money would I get back?'

(*b*) 'If I bought 12 rupees worth and gave the shop-keeper 15 rupees, how much would I get back?'

(*c*) 'If I bought 11 rupees worth and gave the shop-keeper 20 rupees, how much would I get back?'

The problems are to be solved orally. If two answers are given the second is to be scored according to the general rule.

Remarks. Binet uses actual coins and makes the problem one of shop-keeping. This procedure makes it a little more concrete, and perhaps slightly easier. The child is made the shop-keeper and he has some boxes to sell and some cash. The cash placed before him is in definite coins. The experimenter wants to purchase one of the boxes and offers a higher coin and asks for change. The child is actually required to make up the change from amongst the coins and hand over the same to the experimenter. Binet places this test in year IX. Burt, following the same procedure with English coins, places it in year VIII. We have followed Terman's method of verbal arithmetic with Indian coins and have found it easy enough for year IX and slightly too difficult for year VIII.

The test requires on the part of the child not only a knowledge of the processes of addition and subtraction, but the ability to visualize the transaction and find out which of the two operations, addition or subtraction, is to be employed in this transaction. The process of imagining a transaction from auditory sensations is really a hard one and cannot be successfully tackled by feeble-minded children of very much higher age. They begin to add or sometimes even to multiply instead of subtracting.

IX, 3. Giving Similarities—two things. (2 out of 4. Any real likeness is plus. 1 minute each.)

TEXT AND PROCEDURE

Say to the child,

'I am going to name two things which are alike in some way, and I want you to tell me how they are alike.'

(*a*) 'Mango and banana—in what way are they alike?' Similarly,
(*b*) Iron and silver.
(*c*) Steam-ship and tonga.
(*d*) Wood and charcoal.

After the first pair it is not necessary to repeat the whole formula. Simply say,

'In what way are . . . and . . . alike?'

The child very often, probably not liking to lift the heavy burden of finding a solution to the problem, says he does not know, or they are not alike. Then it is necessary to say to him in a persuasive tone,

'They *are* alike in some way. You must tell me in what way they are alike.'

If a difference is given instead of a similarity, say,

'No, I want you to tell me how they are alike. In what way are . . . and . . . alike?'

Remarks. The test of giving similarities is psychologically harder than that of giving dissimilarities. While the latter is easy enough for year VII, the former, even with the lenient way of scoring it, namely making two out of four enough for a plus, is hard enough for year IX. The test of giving similarities was used by Binet in 1905, but was not standardized for any age.

It was standardized by Terman and located in year VIII. Feeble-minded, as well as younger children, more often give dissimilarities, which shows that the mind first tries to distinguish between objects by noting differences before noting similarities. This test is not timed by Terman, but for reasons already explained it has been found better to time it.

IX, 4. Using Three Words in a Sentence. (2 out of 3. Oral. 1 minute each. Repeat formula once again, if necessary.)

TEXT AND PROCEDURE

The three sets of words are:

(*a*) Boy, ball, river.
(*b*) Work, money, men.
(*c*) Trees, rivers, lakes.

'You know what a sentence is, of course. A sentence is made up of some words which say something. Now, I am going to give you three words, and you must make up a sentence that has all three words in it. The three words are—boy, ball, river. Go ahead and make up a sentence that has all three words in it.'

The answer must be given orally. Similarly with the other sets of words, but with these sets use the shorter formula: 'Now make up a sentence having the words. . . . in it.'

If the instructions are not comprehended repeat them once again, but never change the formula in any way.

If it is found that the child is labouring under the misapprehension that the sentence is to be made up only with these three words and that no other words are to be used, say,

'The three words must be put with some other words, so that all of them together will make up a sentence.'

If the boy thinks that the three words are to be used in three sentences, say,

'No. Make only one sentence using all three words.'

To be regarded as plus, (i) the sentence must be a simple sentence, and (ii) it must make good sense and should contain no absurdity.

Remarks. Binet's procedure is to give only one trial with the words—Paris, river, fortune. He also requires a written response, and this makes the test a little harder, locating it in year X. We have followed Terman's procedure of giving three trials with three different sets of words and requiring an oral response. This procedure is certainly better than Binet's and leaves less to mere chance. With this procedure the test is well suited to year IX as was found by Terman also. In the third set of words we have replaced 'desert' by 'trees' as it was found that Indian children have generally no knowledge of deserts.

In scoring the responses, we have not met with the difficulties mentioned by Terman or Burt in the English construction of sentences. Terman has allowed a compound sentence with two distinct ideas as plus for year IX. Burt has allowed two distinct ideas as plus for year X. Our responses show that only one simple sentence with one idea is easy enough for year IX. With English sentences such responses would be hard enough for year X or XI. As regards the second requirement of the sentence, that is containing no absurdity, we also met with no serious difficulty in scoring. The children who gave correct responses from the point of view of sentence structure generally gave sensible sentences.

Burt says:[1] 'A set of sentences in which the thought is well co-ordinated into a unitary story or description, passes (that is for year IX, which requires one idea or sentence). "London is a big place. It has a river in it. And many people come there to make money."' We have distinctly disallowed this. Nor have we found the necessity of scoring this plus with the formula we have used. Binet allows an absurdity in the sentences, but not Terman. We have found that this makes no difference in the score since, as said above, when the first condition is satisfied the second is invariably so.

This test is a very valuable one. It is of the general type of 'completion' tests. For success in it, the associations formed by children of each of these words with other ideas must be very rich, so that when three words are uttered, the children can join them into one coherent idea with the help of these preformed associations. A more intelligent child has always

[1] Cyril Burt, *Mental and Scholastic Tests*, p. 52.

keener observation and forms a greater number of such associations.

IX, 5. Reading and Report: (6 facts: 5 errors: 1 minute.)

TEXT AND PROCEDURE

See VIII, 6.

IX, 6. Free Association, 35 words in 3 minutes. (Record every half-minute score separately.)

TEXT AND PROCEDURE

Say,

'Now, I want to see how many different words you can name in 3 minutes. When I say "ready", you must begin and name the words as fast as you can, and I will count them. Do you understand? Be sure to do your best, and remember that just any words will do, like "clouds", "dogs", "chair", "happy", "come", "go", Ready; go ahead.'

The instructions may be repeated once again if they are not understood. But generally there is no necessity for this.

Do not disconcert the child by staring at him. Keep your eye away from him or on your record sheet. Record the words verbatim if possible, but if there is no assistant, this is generally not possible. It is interesting to record at least the class of words given, such as concrete objects, abstract ideas, verbs, adjectives, and so on. Repetitions should not be counted.

If the child stops altogether, wait for 15 seconds and then say,

'Go ahead as fast as you can. Any words will do.'

Keep on urging like this if the child stops for more than 15 seconds.

Some children begin to give sentences or to count; then say,

'Counting (or sentences) is not allowed. You must name separate words. Go ahead.'

Proper names are not allowed; but mythological names may be allowed.

Remarks. This is a test which was found to be most deceptive in its working, particularly in the form in which Binet used it, namely, giving sixty words in three minutes. While even many normal adults could not pass in this test, with a score of

sixty words, there were a few children even of nine and ten years of mental age who could give more than sixty words. From the percentage of passes, the test in Binet's form was found difficult even for the adult stage. Then the difficulty sometimes arose, whether a child who passes in this test but fails in all the tests of years XII and XIV, should be scored plus only in this test in year XVI. For these reasons, the test is relegated to the class of alternative tests and is located in year XVI. For interesting comparison, the actual number of words given by all children above the level of seven years of age was recorded, and the mean and median scores of children of the several chronological ages were found out. The table below gives the mean and median scores at the several ages.

Chronological age	Number of children	Mean score in 3 m.	Median score in 3 m.	Remarks
7 to 8 years	22	35	35	Low score in tenth year probably due to detained children in Primary IV.
8 to 9 „	50	38	37·5	
9 to 10 „	61	34	30	
10 to 11 „	86	42	40	
11 to 12 „	75	43	40	
12 to 13 „	70	48	47	
13 to 14 „	59	55	56	Note that there is practically no rise above the 14-year level.
14 to 15 „	36	52	48	
15 to 16 „	26	56	53	
16 to 17 „	28	52	48	
17 to 18 „	13	54	48	
18 to 20 „	20	58	60	

It was thus found that the normal score for age IX was 35, and that for 'very superior adults' was 80. At these two extremes, the test is more reliable than at year XVI. Now and then a child is found who sits silently throughout the three minutes although encouraged several times to give words. Sometimes a child gives three or four words and then goes on repeating these same words several times, at the same time appearing to make an

effort to find new ones. This is an interesting form of stereotypy and is a symptom of weak minds.

When this widely divergent speed of association revealed by Indian children is compared with that of western children, one is inclined to believe that the very slow environment of eastern children is responsible for this. The western child is surrounded by men and objects that are moving fast and is forced constantly to think and react to these very speedily so that quick thinking, and the speedy movement of associated ideas in the mind, grow into a habit with him. On the contrary, the environment of an eastern child being very slow, there is no necessity for him to think speedily at all. The same thing is also to be seen in Indian schools. The teachers never pay regard to the cultivation of speed in work and the children go on at their own snail's pace. In the street the schoolboy lazily plods along in tune with the surrounding moving objects, the slow-moving cart, the leisurely cowboy and so on. Of course, in some of the greater Indian cities life is very much quicker, but the population of our cities, as compared to the general population, is like a drop in the ocean. So the speed of work of our general population is very much slower, and speedy work means a speedily thinking mind. The lesson we have to learn from this for our educational system, is to devise ways and means to cultivate speed in our school work. This need is all the more urgent on account of our slow environment. Our arithmetical problems and other pieces of school work may be timed and the normal speed of accomplishing these pieces may be determined and children trained to attain this speed. Only by such methods can we hope to remedy a fundamental defect in our educational and social systems. The writer for some time tried a method of classroom teaching which greatly enlivened the children and was instrumental in cultivating speed in their work. When an example or piece of work was set, the children were asked to work it out and return their answer books, which were arranged on the master's table in order of precedence. The books were then marked in such a way that the earlier children got more marks. For example, the first boy if his work was right got 10 marks, the second and the third got 9 marks, the fourth and the fifth got 8 marks and so on. This enlivened the children very much and after a short time the children understood the

value of quick working. This is mentioned only as an example of how teachers may devise simple classroom methods to attain the object in view.

The habit of rapid thinking is certainly an important factor for success in this test. Some psychologists have thought that the surrounding objects afford clues to words and require children to close their eyes during the test. Far from helping the children, the presence of a number of object is a hindrance in the way of selecting words quickly. It was observed again and again that though a child began naming one or two surrounding objects he could not proceed. When he named a table or a cupboard he seemed to exhaust the objects around him. Nor could he see that the 'drawers' or 'handles' or 'books' (in the cupboard) were new words. After giving only one or two names of surrounding objects he usually fell back on his mental resources and began to give words from his imagination. What Binet has said about *absent* objects applies equally well to *present* objects. He says:[1] 'Little children exhaust an idea in naming it. They say, for example, "hat" and then pass on to another word without noticing that hats differ in colour, in form, have various parts, different uses and accessories, and that in enumerating all these they could find a large number of words.' There is therefore no point in making children close their eyes which, in the case of some children, being unusual, even disconcerts them and obstructs their thought processes. The room in which children are tested may, if so desired, be as bare as possible, as Terman advises; but even this is found to be unnecessary. The fact that, though children are surrounded by a number of identical objects, some of them can name a good many and others hardly any, is an excellent illustration of the fact that the same physical environment can assume various different forms according to the mental ability and equipment of the observers. Thus the sight of the same flower may excite only a vague colour sensation in a child, may present a beautiful and æsthetic shape to an artist or may appear to be made up of several important parts such as stamens or pistil to a botanist.

The most intelligent way of tackling the problem is to give the names of objects, or parts of objects, connected with the object that is named. For example, a child gives the word

[1] Quoted from Terman, *The Measurement of Intelligence*, p. 273.

'tree' and then names its parts such as 'branches', 'leaves', 'flowers', or gives names of objects associated with the given word, such as 'garden', 'creepers' and so on. Such an intelligent method is followed by very few children. Only about two or three children in the whole of our testing did this. The majority of children named an object and then gave one or two objects associated with the given word and passed on to think of objects more distantly associated with it.

Only a very few of the children go on finding abstract words or words having abstract relationship with the given word. No doubt, only advanced children are capable of doing this; but merely from the point of view of giving the maximum number of words, such a method is not a very successful one.

It is interesting to note some of the causes of failure in this test. First of all, it is the poverty of mental content and previously formed mental associations that is the main cause of failure. As Terman says: 'The main factors in success are two, (1) richness and variety of previously made associations with common words; and (2) the readiness of these associations to reinstate themselves.' But apart from this poverty of mental associations, there are certain other factors which cause failure in this test even with some intelligent subjects. Some children fail owing to their very emotional nature; they are too shy or nervous. In fact, shyness plays a greater role in this test than in any other. Some intelligent children get the impression that they are to give very difficult or out of the way words. Hence they waste time in finding these. A few are led away by verbal associations of similarity of sound, and begin to give words rhyming with the given words, although they are warned against it. This occurs more particularly when the test of finding rhymes is given before this test.

Children who are talkative succeed with this test better than thoughtful but more reticent children, although the former may be far less intelligent than the latter. Some children are given to hasty work and hasty replies. Such children fail in some other tests merely on account of their haste but these get a counterbalancing advantage in this test. From this point of view, the test deserves a place in this scale since some children who undeservedly lose in some of the other tests merely from their over-haste, justly get some advantage in this test.

The rate at which words are given does not remain constant. Usually the number of words given in the first half minute is larger and they fall off gradually towards the end of the period. The average number of words given by 10-year-old children in the successive half-minute periods is as follows:

	Half-minute periods					
	1st	2nd	3rd	4th	5th	6th
Bombay-Karnatak ...	10	6.2	5	4.8	4	3.8
Stanford revision ...	18	12.5	10.5	9	8.5	7
London revision ...	19.3	13.4	10.3	8.5	7.3	6.6

Burt's figures however are obtained in a slightly different way. They are the average number of words in the successive half-minutes given by children who *pass* in the test. Further, the average age of Terman's group seems to be 10 years, that of Burt's group 9.5 years, while in the present study it is 9.5 years.

The corresponding average scores in the successive half-minute periods in the present revision for adolescents of fifteen and sixteen years of age are as follows:

	Half-minute periods					
	1st	2nd	3rd	4th	5th	6th
Average age 14½ years ...	16	9	8	7	6	6
Average age 15½ years ...	17.7	10.6	8.5	7	5.8	6.4

For comparing simply the speed of association in different half-minutes it is better to work out the percentages of words given in these half-minute periods. They are:

	1st	2nd	3rd	4th	5th	6th
Bombay-Karnatak ...	29.6	18.3	14.8	14.2	11.8	11.2
Stanford revision (Terman)	27.5	19.1	16	13.7	13	10.7
London revision (Burt) ...	29.5	20.5	15.7	13	11.2	10.1

It will be seen that the biggest drop in all the revisions is after the first half-minute. There is no warming-up period.

Lastly, some of the very backward children give sentences instead of words, even though they have been told to give words and not sentences. This seems to suggest that the units of ideas are sentences and not words. When a child thinks of a horse, can he get an image of the horse simply, or does he imagine

yoked to a tonga', 'I saw a horse in the bazaar'? There are very strong reasons to suppose that the latter form is the unitary form of our ideas, though we may not be sufficiently trained in the use of language to express these ideas in the form of sentences. The subject is one which requires exhaustive study.

IX, Alternative. Vocabulary, twenty words. (Equivalent to 7,200 out of 36,000 words of Marathi language; or to 5,600 out of 28,000 words of Kannada language.)

TEXT AND PROCEDURE

Place the card of printed words before the child, and say,

'I want to find out how many words you know. Listen and when I say a word, you tell me what it means.'

'What is an orange?'[1]

'What is a bonfire?'

'Roar. What does roar mean?'

If the child hesitates being diffident about giving a proper definition, say a little encouragingly,

'You know what a bonfire is. You have seen a bonfire. Now what is a bonfire?'

If the child is still silent, say further,

'Just tell me in your own words: say it any way you please. All I want to find out is whether you know what a bonfire is.'

If the child's answer is not quite satisfactory, or is imperfect, say,

'Explain. I don't understand. Explain what you mean.'

Adhere strictly to the above formulæ. Never illustrate the use of a word in any way, such as by using it in a sentence. Rigid definitions are not expected from children. Sometimes in giving meanings even a change of part of speech is allowed.

Remarks. In assessing the definitions given by children great leniency needs to be shown, because the power of expression of children, particularly below the age of twelve years, is very poor. In the twelfth year they just begin to define abstract words correctly (see XII, 3). Hence below this level, provided

[1] These words are given only for the sake of illustration. The actual words of the vocabularies in the two Indian languages are given on the vocabulary cards of these versions.

the child shows that in some way he knows the meaning of a word the definition should be scored plus. Nouns may be rendered into adjectives or verbs, or again in terms of long explanatory sentences but, so long as the correct idea is expressed, the response should be scored plus.

For scoring purposes, it is enough if the child defines the requisite number of words, for example 20 words from both lists together in this year. But it is interesting to find the total vocabulary of the child in every case. It is done as follows. This list consists of 100 words selected from a small Kannada dictionary containing about 28,000 words. These 100 words are chosen according to a definite scheme, say the first word from every fifth page. That is, these 100 words are representative of the 28,000 words in the dictionary. Thus if a child can define only 20 words out of 100 (if only one side is used only 10 words are enough, which should be doubled), he would be able to define 20 per cent of the whole number of words in the dictionary; that is, his total vocabulary according to the law of chance is 5,600 words. The Marathi dictionary from which the list is made up consists of 36,000 words, so the average Marathi vocabulary of a child of 9 years is 7,200 words. Strangely, the average number of words defined by Kannada and Marathi children in the several ages came very nearly to the same figure. So we have retained the same figure for both Kannada and Marathi children for all the ages. The following table gives the mean and median scores of Kannada and Marathi children separately in the several years:

Age next birthday		8	9	10	12	14	16	Above 16
Kannada	Mean	20	23	25	31	37	45	52
	Median	20	23	25	30	38	46	52
Marathi	Mean	14	20	25	31	49	49	50
	Marathi	13	19	25	27	48	46	51

The 'vocabulary' test should not be given unless the mother-tongue and the language learnt by children in the school are the same. In Kannada districts quite a number of children have Marathi as their mother-tongue and learn Kannada in schools,

and vice versa in Marathi districts bordering on Karnatak. In such cases, it has been found doubtful which of the two languages a child knows better. Hence the test has been standardized only on children whose mother-tongue and school language coincide. Contrary to expectation the test has been found to be a very good test of intelligence. One might have thought that the test depended a good deal on schooling, but it is not so. The correlation of this test with mental age as determined by the scale as a whole is 0.89. Just as an intelligent child picks up from his environment more knowledge than a duller one of the same age, so also he picks up more words from the language. Thus a wider vocabulary means wider knowledge and higher intelligence.

CHAPTER XV

TESTS FOR YEAR X

X, 1. Arranging Five Weights. (*2 trials of 3 correct.*)

TEXT AND PROCEDURE

Use five pill-boxes $1\frac{1}{4}$ inches or a little less in diameter, all identical in appearance and load them with lead foil or lead shot until they weigh 3, 6, 9, 12 and 15 grammes respectively. The contents should be properly packed in cotton wool and should not rattle. The lead shot or foil should be as far as possible in the very centre. Mark these boxes on the under surface by letters like P, S, Y, C, H, so that after the child has arranged the boxes, the examiner can silently turn them over and check the arrangement. Place these boxes on the table in an irregular fashion before the child and say,

'See these boxes. They all look alike, don't they? But they are not alike. Some of them are heavy, some are not quite so heavy, and some are still lighter. No two weigh the same. Now, I want you to find the heaviest one and place it here. Then find the one that is just a little lighter and put it here. Then put the next lighter one here, and the next lighter one here, and the lightest of all at this end (pointing each time at the appropriate spot). Do you understand?

'Remember now, that no two weights are the same. Find the heaviest one and put it here, the next heaviest here, and lighter, lighter until you have the very lightest here. Ready, go ahead.'

Note that the instructions are repeated with a shorter formula. This is always necessary.

If the child still does not understand, repeat the whole of the instructions once again. No further help should be given. The child should not be shown how to weigh the boxes in his hand; finding out the correct procedure is part of the test.

Some children get the impression that the performance should be done as quickly as possible; others take a longer time and check their first arrangement. For uniformity after the first arrangement, it is better to say,

'See again if you have placed them properly.'[1]

Remarks. Always record the order in which the child places the boxes. According to Weber's law, the ease with which the differences between successive weight boxes are distinguished should be in ascending order beginning from the end of greatest weight, the hardest difference to distinguish being that between 15 and 12 grammes and the easiest one that between 6 and 3 grammes. On referring to the actual statistics we find that the percentages of passes in estimating the differences between the successive pairs are:

Difference between	15	and	12	grammes		77%
,, ,,	12	,,	9	,,		91%
,, ,,	9	,,	6	,,		94%
,, ,,	6	,,	3	,,		86%

This is a corroboration of the truth of Weber's law. The slight fall in percentage in the last pair appears to be due to the fact that the lightest weights are so light that it is difficult even to feel their weight on the hands.

This is not merely a test of sensory discrimination. If it were it would, probably, be of less value as a test of intelligence; for, as has been observed already, even lower animals sometimes have greater sensory discrimination than man. Binet calls it a test of 'sensorial intelligence'.

The test requires in the first place proper comprehension of the instructions; in fact, this is an important factor in the proper solution of the problem. We have therefore always insisted on laying down accurate procedure in giving the instructions. The wording of the test should not be changed even in the slightest degree. The speed with which the instructions are given, the proper enunciation of the phonetic sounds, the emphasis on key-words, the number of repetitions of the instructions, should all be carefully laid down. In comprehending the instructions the children are required to visualize the several items of perform-

[1] After this formula there is sometimes the chance of a correct arrangement being spoiled, but we are unable to help this. The formula is to be given in all cases. Terman expressly disallows this last step, though some other workers have allowed it.

ance contained in the text of instructions, keep them in mind till all the items are given, weave them together so as to form one whole, and decide upon the goal to be reached. After the goal to be reached is discovered a great effort of attention is required to keep it in mind until the several adjustments and adaptations, that are required to reach the goal, are made.

This test is one of the most interesting tests from the children's point of view. It is a test which requires some *doing* on the part of children. Children are fonder of doing concrete things than of listening to things or thinking in the abstract. The test, therefore, serves as a great relief when given after a good many other tests that require abstract thinking. If it is given at the beginning it arouses the child's interest and he takes to testing more kindly afterwards. The correlation of the test with mental age however is not very high. It is 0.57.

Note down any peculiarities in the performance. Intelligent children lift the weights and balance them by slight movement up and down in the hand, sometimes successively in the same hand, sometimes simultaneously in the two hands. The former method is the better of the two. Backward or younger children often lift two or all of the boxes together in the same hand. Another point in which backward children generally fail is in grasping the idea of arranging the weights in descending order of weight.

X, 2. Repeating Twenty to Twenty-two Syllables. (1 out of 3: or 2 with 1 error each.)

TEXT AND PROCEDURE

(*a*) 'The apple tree makes a cool pleasant shade on the ground where the children are playing.'[1]

(*b*) 'It is nearly half-past one o'clock; the house is very quiet and the cat has gone to sleep.'

(*c*) 'In summer the days are very warm and fine; in winter it snows and I am cold.'

Procedure same as in VII, 1.

[1] The Kannada and Marathi versions are not mere translations, but the number of syllables is kept the same.

Remarks. It is interesting to note how the memory for syllables increases with age. The following table gives this comparison:

Age in years	No. of syllables given	Increase in age in years	Increase in syllables given	Increase per year
III ...	7	...	...	...
IV ...	13	1	6	6
VII ...	18	3	5	1.7
X ...	22	3	4	1.3
XIX ...	30	9	8	.9

The increase per year in the number of syllables given steadily decreases as the child advances in years. Compare the increase in the number of digits given as age increases (see p. 117).

X, 3. Naming the Months. (20 seconds: 1 error in naming. 2 checks of 3 correct.)

TEXT AND PROCEDURE

'Name all the months of the year.'
'What month comes before April?'
'What month comes before July?'
'What month comes before November?'

Ask these questions striaght away and give no other help, even to start him off with any one month. The child may start with any month provided he completes the cycle.

Keep a record of the time from the moment the child names the first month. Sometimes even intelligent children may not recollect the name of the first month at once and may waste a good deal of time.

Remarks: See Remarks under VII, 4, on time orientation.

This test is criticized on the score that it depends a good deal on schooling or training. But it is one thing to know the months by rote and quite another thing to have time orientation of this order. The checks in particular and test X, Alternative 2, go to show whether this much time orientation has appeared. On the whole, the test has served its purpose well and there is not much weight in the criticism.

X, 4. Drawing Designs from Memory. (1 correct, 1 half-correct. Expose 10 seconds.)

TEXT AND PROCEDURE

Before exposing the card say to the child,

'This card has two drawings on it. I am going to show them to you for ten seconds, then I will take the card away and let you draw from memory what you have seen. Examine both drawings carefully and remember that you have only ten seconds.'

Provide the child with paper and pencil and then expose the card for ten seconds, taking care that the card is presented to him in the right position, with the Greek key pattern to his left and the truncated pyramid to his right. After ten seconds quickly remove the card out of sight and cover it up or insert it in the packet, so that there is no temptation on the part of the child to cast his glance in that direction. Let the child begin to draw as soon as possible after the card is removed. The drawings on the scoring card will help the examiner to mark each diagram correct, half-correct or wrong. The following hints will be found useful in scoring.

Correct: The peculiarities of the drawings as regards right angles, the different individual parts and eccentricity of the inner rectangle are all correctly reproduced. The drawing need not be neatly drawn from the artistic point of view nor the straight lines perfectly drawn. One of the rectangles in the truncated pyramid diagram may be drawn square or one of the top squares in the Greek key pattern may be turned outside. The eccentricity in the truncated pyramid may be shown in any direction. The whole diagram may be inverted if otherwise perfectly correct.

Half-correct: The drawings are generally correct, but some (only one) important peculiarity may be wrongly drawn or not drawn at all; for example eccentricity is not shown at all; both rectangles are drawn as square or vertical rectangles in the truncated pyramid; angles are rounded off instead of being drawn square; the turns in the Greek key pattern are drawn sometimes less sometimes more in number.

Failure: When the figure is incorrectly drawn as regards more than one of the essential peculiarities.

Remarks. It is difficult to lay down exactly in words what constitutes a success, a half-success, or a failure. The sample drawings shown on the scoring cards will be a great help. Burt has attempted to analyze the errors and lay down the method of scoring, but his scoring seems to be a little too lenient.[1] The first two diagrams of the truncated pyramid which he shows as successful will have to be taken as half-correct according to the above instructions.

According to Binet, the chief factors required for success in this test are 'attention, visual imagery, and a little analysis'. The child has to concentrate his attention on the drawings, fix the visual imagery in his mind, with some analysis as to how the lines are placed and their relative sizes. There is another important factor which intelligent children make use of and which is not mentioned by Binet. This is the motor memory. The child, as he sees the diagrams, traces the lines in his mind imagining his fingers going round the diagrams. When he does this, the chances of his success are greater as his motor memory comes to his help where his visual imagery fails. According to Terman, analysis is an important factor. He points out that one of the diagrams consists of thirteen lines and the other of twelve and this number is much beyond the memory span for lines, unless these lines are grouped and the grouping analysed and remembered as a lesser number of units. For example he says: 'The design to the right, which is composed of twelve lines, may be reduced to four elements: (1) the outer rectangle; (2) the inner rectangle; (3) the off-centre position of the inner rectangle; and (4) the joining of the angles. Of course the child does not ordinarily make an analysis as explicit as this; but analysis of some kind, even though it be unconscious, is necessary to success.'[2] It should be remembered also that the time of exposure in this experiment is much more than the time usually allowed in tachistoscopic studies by which memory span is determined.

Binet and Burt placed the Greek key pattern to the right and found that failures on this were much more frequent than failures on the truncated pyramid pattern. This is probably due to the fact that the figure on the left hand receives our greater attention, because as a result of our reading habits it is examined

[1] Cyril Burt, *Mental and Scholastic Tests*, pp. 53-5.

[2] Terman, *The Measurement of Intelligence*, p. 261.

first. Terman reversed the position and found that the failures were almost equally divided between the two. The more difficult figure was placed to the left and secured greater attention. Our statistics agree with Terman's and show that the failures on the Greek key pattern are almost exactly equal to the failures on the truncated pyramid pattern. A good many children, however, drew the second figure first, though it was placed to the right in the original. This is probably because they thought it easier and they could attempt it first.

Binet (1911), Terman and Burt all agree in placing this test in year X. Our statistics also do the same.

X, 5. Finding Rhymes. (3 rhymes for each word. 1 minute for each part. 2 out of 3 correct.)

TEXT AND PROCEDURE

Say,

'You know what a rhyme is, of course. A rhyme is a word that sounds like another word. Two words rhyme if they end in the same sound, understand? Take the two words "hat" and "cat". They sound alike and so they make a rhyme. "Hat" "rat", "cat", "bat" all rhyme with one another. Now, I am going to give you a word, and you will have one minute to find as many words as you can that rhyme with it. The word is "day". Name all the words you can think of that rhyme with "day".'

If the child begins to give words without meaning, say,

'The words you give must have meaning.'

If the child fails with this, give three words that rhyme with 'day' and say,

'All these sound alike with "day". Do you understand?'

Proceed further after this, or directly after the child has given correct rhymes with the first, as follows:

'Now you have another minute to name all the words you can think of that rhyme with "mill".'

Similarly with the third word 'spring'.

If the child gives words that have no nasal sound, say,

'I want words with a nasal sound.'

Scoring should be done liberally taking as correct proper names and negative terms formed by adding a prefix to the given word, provided they rhyme properly.

Remarks. Binet's procedure of giving this test, as also that of Burt, seems to be much harder than this one which is Terman's. Binet gives only one word and requires three rhymes. In the present procedure three trials are given requiring three rhymes for each, of which two have to be correct. Again Binet's word is trisyllabic, and Burt's dissyllabic, which are both consequently harder than Terman's monosyllabic words. Our words are dissyllabic, but they are easy enough, perhaps easier than monosyllabic words, as monosyllabic words would be harder to give in the Indian languages than dissyllabic ones. Besides, the illustrations given in Terman's version are more elaborate than Binet's. This seems to be responsible for the wide divergence in the location of the test. Binet (1911) locates it in year XV, Burt in year XII, Terman in year IX, while the present revision places it in year X.

The test is found to be a very good test of intelligence and it satisfies very well all the requirements of such. Its correlation with mental age as determined by the scale as a whole is 0.78, and the percentage of passes in the test from year to year shows a fine rising curve. Psychologically the test requires the child to fix the goal permanently in mind and under the guiding force of this goal to find other words of similar sound by a trial and error method. After a word is found, it must be compared with the given word, the memory of which is also firmly retained and the child sees whether the new word satisfies the condition laid down. This is no mean task for the associative powers of the mind. A little remissness in any of these essential requirements results in failure. Backward children either fail to keep the goal fixed in mind, or to remember the given word, or to awaken their powers of memory by which the whole store of vocabulary is searched for similar words by the method of trial and error or of verbal associations, or finally in the power of self-criticism. Thus when the word 'hill' is given the child makes words like 'fill', 'rill', 'bill', and sees which of these words are in his vocabulary. The mind of a backward child works like that of a normal child in a sleepy condition. The mind is dissociated and cannot hold together all the conditions laid down in the problem. One or more of these slip out and hence the solution is incorrect.

X, 6. Reading and Report. (8 facts: 2 errors: 40 seconds.)

TEXT AND PROCEDURE

See VIII, 6.

Remarks. Terman allows 35 seconds for reading, while we have allowed 40 seconds. But Terman's English passage contains 68 syllables, while our Kannada passage contains 134 syllables and the Marathi passage 116 syllables.

X, Alternative 1. Vocabulary, twenty-five words.

TEXT AND PROCEDURE

See IX, Alternative test.

X, Alternative 2. Giving Month and Year. (Both correct.)

TEXT AND PROCEDURE

'What month is it?'

'What year is it?'

The name of the month must be given, and not simply the number, and the year—both according to the Christian calendar.

See VII, Alternative test.

CHAPTER XVI

TESTS FOR YEAR XII

XII, 1. Detecting Absurdities. (3 out of 5. ½ minute each. After 5 seconds read a second time.)

TEXT AND PROCEDURE

Secure the child's attention and say,

'I am going to read a sentence which has something foolish in it, some nonsense. I want you to listen carefully and tell me what is foolish about it.'

Then read each of the following twice, as stated above, emphasizing the key words:

(*a*) 'A man said, "I know a road from my house to the town, which is downhill all the way to the town and downhill all the way back home."

'What is foolish about that?'

If the child's answer is not clear say again,

'I am not sure that I know what you mean. Explain what you mean. Tell me what is foolish in the sentence I read?' Similarly the rest.

(*b*) 'An engine driver said that the more carriages he had on his train the faster he could go.'

(*c*) 'Yesterday the police found the body of a girl cut into eighteen pieces. They believe that she killed herself.'

Sometimes children say this is foolish because nobody kills herself. Then say, 'She might have been tired of life and might have thought of killing herself.'

(*d*) 'There was a railway accident yesterday, but it was not very serious. Only 48 people were killed.'

(*e*) 'A bicycle rider being thrown from his bicycle in an accident, struck his head against a stone and was instantly killed. They picked him up and carried him to the hospital, and they do not think he will get well again.'

Any sensible answers are correct.

Remarks. Of the five sub-tests in this test three are Binet's, namely, (*c*), (*d*) and (*e*). The first two are substituted by Terman for Binet's two sub-tests which are as follows:

(1) 'I have three brothers—Jack, Tom and myself.
'What is silly in that?'

(2) 'A man once said: "If I should ever grow desperate and kill myself, I shall not choose a Friday to do it on; for Friday is an unlucky day, and would bring me bad luck."'
'What is foolish in what the man said?'[1]

These two appear to be slightly harder than Terman's. The difficulties in these tests pointed out by Terman do not exist in Indian languages, but we have preferred to retain Terman's selections. Terman, however, requires four to be correct out of five, while Binet would require only three out of five. The latter procedure is better, and with this procedure we found that the test is suitable for year XII; that is, about 40 per cent of children between 10 and 12 years of age and 74 per cent of those between 12 and 14 years pass it. With Terman's procedure, that is on the basis of four out of five, the test is found to be hard enough for year XIV in which 53 per cent pass the test.

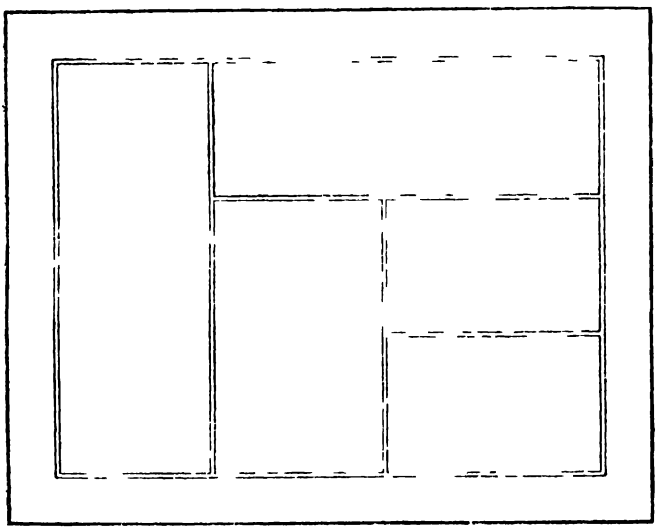
The test is one of the best tests in the series, in that it hardly requires any schooling or training and children of this age with common sense or 'mother wit' can easily pass it. It correlates very highly with the mental age as determined by the test as a whole, the correlation being nearly 0.9 It requires on the part of the child the ability to *visualize* the items given and find out the logical incongruity between the several items. For this of course the child must have acquired a previous knowledge of certain facts, such as the slope of a road and the apperceptive mass connected with it obtained by actually walking over such roads; or the experience that a heavier vehicle is harder to pull and moves with less velocity, and so on. The greater the number of items to be reconciled and the less organized the acquisition of previous experience, the more difficult the test. The logical incongruity assumes various forms in the different subtests. In the first the child is required to know all the properties of a sloping road, such as that walking down it is easier than walking up, water flows down such a road and not up and hence to reason that the same road cannot be downhill both ways. For the second problem, the child is required to have possessed kinæsthetic memories of heavy and light carriages.

[1] Cyril Burt, *Mental and Scholastic Tests*, pp. 56 and 57, which give Binet's tests adapted for London children.

The child in various ways in his childhood gets experience in drawing toy carts or other loads and preserves these memories in his nervous system connected with the muscles that are used in dragging such loads. Such kinæsthetic memories now help the child to reason that a heavier train cannot move faster than a lighter one. In the third problem, the child has to visualize the girl cutting herself into eighteen pieces and to bring into proximity with this his knowledge that a living thing dies immediately it is cut into two pieces and being unable to do anything further cannot cut itself again. In the fourth problem, the visualization is also very important but more difficult. The child must create a mental picture of a train that is derailed or some such thing and of forty-eight people that are dead. Then only the child sees the gravity of the situation. In the fifth also very much the same kind of visualization is necessary. The child's attention must be focused on the picture of the cyclist dying on the spot. Then only can he find the incongruity of this statement with those that follow.

XII, 2. Construction Puzzle. (Healy and Fernald, 3 times in 5 minutes.)

TEXT AND PROCEDURE



The above is a drawing of the dimensions of the form-board with the several pieces fitted into it. It can be locally made by a careful carpenter. It is an open rectangular box whose external dimensions are $3\frac{1}{2}$ in. $\times$ $4\frac{1}{2}$ in. $\times$ $\frac{1}{2}$ in. deep, while inside it measures 3 in. $\times$ 4 in. $\times$ $\frac{1}{4}$ in. deep. The wood pieces that fit in are $\frac{1}{4}$ in. in thickness and are 5 in number. Their dimensions are $3 \times 1\frac{3}{16}$ in.; $2\frac{3}{4} \times 1$ in.; $2 \times 1\frac{1}{4}$ in.; $1 \times 1\frac{1}{2}$ in.; $1 \times 1\frac{1}{2}$ in.

Place the outer frame of the form-board on the table in front of the child with the longer side nearest to him.[1] Put all the smaller pieces in a heap before him a little further away than the frame. The smaller blocks fitted in in their proper position should not be seen by the child. Then say to the child.

'I want you to fit in these blocks in this frame as quickly as possible. If you do it rightly they will all fit in and there will be no space left over. Go ahead.'

For a plus he must do it three times in a total time of five minutes.

Remarks. It is very interesting to observe children performing this feat. Intelligent children do it with a proper understanding of space relations. Backward children cannot project their imagination even slightly, and proceed with the performance till the last move even though, obviously, success by these moves is impossible; or they put the first piece in such a way that a small gap is left at its side, where obviously no other piece could go; or again they try to insert a broad piece in a much narrower space and go on trying to force it in though it is quite clear that it cannot go in. There is always an element of trial and error in the performance of both intelligent and backward children, but in the case of intelligent children there is more *insight* and less *trial and error* while in that of the backward there is more of trial and error and less of insight.

This test is quite apart from other tests in that it requires no linguistic ability and depends only on the ability of manipulation. It is therefore a very good test as a change. Terman says: 'The test has a lower correlation with intelligence than most of the other tests of the scale.' Our finding however is quite the reverse. It has a very high correlation with mental age as

[1] Terman places it with the shorter side nearest to him. Apparently both are alike in the results.

determined by the scale as a whole, namely 0.85, and it shows a steady rise in the percentage of passes from year to year. We have never found a very backward or a very young child succeeding in it by virtue of mere trial and error in the specified time, nor have we found any very intelligent child failing in it. On the contrary it is a test in which children take very great interest, as intelligent *doing* is always better liked by children than mere verbal reproduction or abstract thinking. Any one who has studied Köhler's experiments on apes will easily see how even simple acts, which appear very simple to us, require very great insight and cannot possibly be performed merely by the method of trial and error.[1] Terman says nothing of doing the performance as quickly as possible, but it appears to be better to tell the child what exactly is expected of him, without making him nervous by unnecessarily hurrying during the performance itself.

XII, 3. Defining Abstract Words. (3 out of 5. 1 minute each to start definition.)

TEXT AND PROCEDURE

The words are:

(1) Pity, (2) Revenge, (3) Charity, (4) Envy, (5) Injustice. Say,

'What is pity?'

'What do we mean by pity?'

If the child answers in terms of the given word itself as 'pity means to pity someone', say,

'Yes, but what does it mean to pity someone?'

Logical definitions are not required. It is enough if the meaning of the word is brought out by any sort of explanation or by examples. It is good to analyse what elements are required in the definitions in order to score them plus.[2]

Pity has the idea of (i) tender feeling or helping attitude, (ii) when another person is in difficulty or is suffering.

[1] See Köhler, *Mentality of Apes*, pp. 130-33. In one instance the chimpanzee, when he was given two sticks which could be telescoped at the ends by fitting the end of one into the hollow of the other tried to reach the bananas by pushing one of these sticks outside the cage with another that he held in his hands.

[2] Cyril Burt, *Mental and Scholastic Tests*, p. 64.

Revenge has the idea of (i) another person doing some kind of injury to us and (ii) our answering it with a similar or a greater injury, either in *thought* or *execution*.

Charity has the idea of (i) giving something to others or showing kindness to others, (ii) when they are in need, or for *religious* purposes.

Envy has the idea of (i) feeling uneasiness or dissatisfaction, (ii) when others are in an advantageous position, have obtained some sort of material gain or superior position.

Injustice has the idea of (i) one's having done something and (ii) another person returning some sort of punishment or act for it that the first act did not deserve. Sometimes the same person (i) may do or think something and (ii) may deny having done it or thought so.

Remarks. Binet's words are 'kindness', 'justice' and 'charity' and he requires two correct responses out of three. Terman has five words, 'pity', 'revenge', 'charity', 'envy', 'justice', and requires three correct responses out of five. We have followed Terman except that we have substituted 'injustice' for 'justice'. The vernacular word for 'justice' is '*nyâya*'. This word unfortunately is colloquially used in a sense almost the opposite of justice. It is used in the sense of 'quarrel'. Hence the word had to be discarded and the opposite word 'injustice' or '*anyâya*' had to be used. This word has no ambiguity about it. Binet's word 'kindness' has been discarded by many subsequent investigators. The definitions cannot easily be scored, perhaps on account of the word being too easy and incapable of being expressed in simpler terms. 'Pity', 'revenge', and 'envy', have also been used by other investigators and admit of easy scoring.

The test was located by Binet (1911) in year XII, with a slightly different procedure as stated above, by Terman in year XII, by Burt in year XIV, by Kuhlmann in year XI, and by Bobertag in year XII. There is thus very great uniformity in the location of the test, which speaks well for its value.

A child's ability to define words can be analysed in the first place into two parts: his conception of the exact connotation of the terms and his power of expression. The former depends on his logical acumen and the latter on the development of his linguistic ability. Both these are found from various kinds of tests to grow side by side with intelligence. When we examine

the vocabulary of children we find that they pick up the names of the most common concrete objects first—possibly those connected with their own bodies or the names of the most common objects in their environment. Thus they learn to name their mother and father first, then they name their hands, eyes, nose, etc. (III, 2); then other less familiar objects in their surroundings such as cat, dog and so on. Here again there are two stages; the stage of recognition and the stage of expression. These two stages exist also in our acquisition of new words as we add to our vocabulary throughout life. For is it not within the experience of every person that when he meets new words in his reading he first seeks to know their meaning? At this stage the person cannot use the word. Later on as he becomes more familiar with the word the associative bonds between the meaning and the system of labial and vocal muscles and the correlative system of nerves which are concerned with speech become so strong that as soon as the person intends to express a certain meaning those words automatically come out of his vocal organs. When a child learns the meaning of a word like 'cat' or 'tree' he does so after a long time. First he carefully studies the things which are called 'cats'. It is by slow observation of the characteristics that are common to all cats that he comes to recognize cats. He commits several mistakes in the early stages. Perhaps he calls a puppy by the name of a 'cat'. Then he is corrected and unconsciously he tries to see what further characteristics he is to add to his idea of a cat in order to exclude dogs from that denomination. Thus slowly by isolating more and more of the abstract characteristics which are common to larger and larger groups of the same class of objects, the child is able to learn the correct application of terms or their use. Still greater difficulty is experienced with abstract terms, such as 'charity' or 'revenge'. Even here the child learns most quickly the names of those abstract terms the ideas of which come earliest within his experience. Thus a child would know the meaning of 'truth' or 'falsehood' much earlier than 'revenge' or 'charity'. The child slowly studies the various acts which explain the abstract terms and unconsciously begins to generalize the use of the terms. The standardization of such tests has brought to light various facts in connexion with the development of the abilities of children and, as the results of

further standardization are published, our knowledge of the growth of children's abilities will become fuller and fuller.

The correlation of the test with mental age as determined by the scale as a whole is 0.88.

XII, 4. Repeating Five Digits Reversed. (1 out of 3. Read 1 per second.)

TEXT AND PROCEDURE

The series for this year is:

3-1-8-7-9; 6-9-4-8-2; 5-2-9-6-1.

Procedure same as VII, 3 and IX, 1.

XII, 5. Interpretation of Fables (4 marks). (2 correct or the equivalent in half-credits, each fable correctly interpreted carrying 2 marks. Time limit 2 minutes after final query is put.)

TEXT AND PROCEDURE

Say to the child,

'You know what a fable is? You have heard fables? A fable as you know is a little story, and is meant to teach us a lesson. Now I am going to read a fable to you. Listen carefully, and when I am through I will ask you to tell me what lesson the fable teaches us. Ready; listen.

(*a*) 'Hercules and the Wagoner.

'A man was driving along a country road, when the wheels suddenly sank in a deep rut. The man did nothing but look at the wagon and call loudly to Hercules to come and help him. Hercules came up, looked at the man, and said: "Put your shoulder to the wheel, my man, and whip up your oxen." Then he went away and left the driver.

'What lesson does that teach us?'

If the child simply repeats the story as a great many do, say only once again,

'What do *we* learn from this?'

If the child's answer is not clear, say,

'What do you mean?' or 'Explain; I don't quite understand what you mean.'

Record the answer of the child verbatim and proceed to the next fable.

'Here is another fable. Listen again and tell me what lesson this fable teaches us.'

(*b*) 'The Milkmaid and her Plans.

'A milkmaid was carrying her pail of milk on her head, and was thinking to herself: The money for this milk will buy four hens; the hens will lay at least 100 eggs; the eggs will produce at least 75 chicks; and with the money which the chicks will bring I can buy a new dress to wear instead of the ragged one I have on. At this moment she looked down at herself, trying to think how she would look in her new dress, but as she did so, the pail of milk slipped from her head and dashed upon the ground. Thus all her imaginary schemes perished in a moment.'

Similarly with the rest.

(*c*) 'The Fox and the Crow.

'A crow, having stolen a bit of meat, perched in a tree and held it in her beak. A fox, seeing her, wished to secure the meat, and spoke to the crow: "How handsome you are and I have heard that the beauty of your voice is equal to that of your form and feathers. Will you not sing for me, so that I may judge whether this is true?" The crow was so pleased that she opened her mouth to sing and dropped the meat which the fox immediately ate.'

(*d*) 'The Farmer and the Stork.

'A farmer set some traps to catch cranes which had been eating his seed. With them he caught a stork. The stork, which had not really been stealing, begged the farmer to spare his life, saying that he was a bird of excellent character, that he was not at all like the cranes and that the farmer should have pity on him. But the farmer said, "I have caught you with these robbers the cranes, and you have got to die with them."'

(*e*) 'The Miller, his Son, and the Donkey.

'A miller and his son were driving their donkey to a neighbouring town to sell him. They had not gone far when a child saw them and cried out, "What fools those fellows are to be trudging along on foot when one of them might be riding!" The old man, hearing this, made his son get on the donkey, while he himself walked. Soon they came upon some men. "Look," said one of them, "see that lazy boy riding while his old father has to walk." On hearing this the miller made his son get off, and he climbed upon the donkey himself. Further

on they met a company of women, who shouted out, "Why you lazy old fellow, to ride along so comfortably, while your poor boy there can hardly keep pace by the side of you!" And so the good-natured miller took his boy up behind him and both of them rode. As they came to the town a citizen said to them, "Why, you cruel fellows! You two are better able to carry the poor little donkey than he is to carry you." "Very well," said the miller, "we will try." So both of them jumped to the ground, got some ropes, tied the donkey's legs to a pole, and tried to carry him. But as they crossed the bridge the donkey became frightened, kicked loose and fell into the stream.'

For a correct response, which gives the correct moral of the fable in general terms, give 2 marks. For responses which give plausible but not exact answers give half credit. As Terman says, these latter responses are of two kinds: '(1) Interpretations which are stated in general terms and are fairly plausible, but are not exactly correct, and (2) those which are perfectly correct as to substance, but are not generalized.'[1]

An example of the first kind is, 'If we pray to God in the time of difficulty, he suggests a remedy to us.'

An example of the second kind is, 'He ought not to sit silent calling out loudly for help. He ought to try himself.'

Remarks. This test was first standardized by Terman in 1911. It is one of the best tests of intelligence as it requires on the part of the child a thorough comprehension of the story and *generalization* of the moral contained in it. The correlation of the test with mental age as determined by the scale as a whole is 0.94. Perhaps a little schooling might be a help in showing the child what a moral is and how to draw it. Beyond that, the children are thrown entirely on their own resources. Again and again it was observed that though the children knew the story and perhaps had also read the moral, it did not help them at all. They had to put forth their best efforts anew to draw the moral and several times failed to do so.

The fable has often been used to test the delinquency of children. It is argued that a child who cannot draw the moral from a concrete situation as in the fable, would not be able to draw it from a social situation and hence would not be able to

[1] Terman, *The Measurement of Intelligence*, p. 293.

guide his conduct. Thus a test that sifts out dull people also sifts out delinquents. This proposition however is challenged by a good many investigators, who say that dullness and delinquency are by no means concomitant. However, it seems possible that in a good many cases delinquency is due to the person's not being able to comprehend the gravity of the situation nor to imagine the results of his actions, which lack of comprehension is certainly due to his mental retardation. To this extent however any test of intelligence would also be a test of delinquency. But there are also cases where delinquency is due to the environment in which the person grows up and the delinquent is helped by his intelligence to be an expert delinquent rather than to cure himself of his delinquency by the width of vision which he gets on account of his intelligence.

XII, 6. Interpretation of Pictures. (3 out of 4. Time limit 2 minutes for each picture.)

TEXT AND PROCEDURE

The formula in this year is the same as in VI, 5. Use the pictures in the following order: (1) Railway station, (2) Reception at home, (3) Motor accident and (4) Domestic scene.

Say to the boy or girl,

'What is this picture about?'

'What is this picture of?'

Generally the same formula as in VI, 5 prompts a response of the interpretation type from children of this mental age. But, if in some cases the reply is doubtful, return a second time to such pictures with the new formula:

'Explain this picture.'

If the reply of the child is not clear, say,

'Explain what you mean.'

Remarks. See Remarks under VI, 5 as to what constitutes interpretation of a picture. The interpretation of the picture is the meaning of the picture as a whole, generally the one the artist intends. But the interpretation given by the children need not be the same; any plausible and not inconsistent interpretation should be scored plus.

The pictures we have selected agree remarkably well with Terman's pictures as to difficulty of description or interpretation. Terman places the description of his pictures in year VII, while we put it (for our pictures) in year VI. Terman places interpretation of his pictures in year XII, and we also place ours in the same year. The selection of pictures is therefore a very important affair; some pictures may admit of interpretation at as high a stage as the adult one, while others may admit of the same as early as the tenth year. Hence results the great divergence in the location of the test. The form of the questions is no less important. Spontaneous interpretations such as those given by our first formula would place the test a little higher than those obtained after specific questions such as 'Explain this picture,' 'What is the meaning of this picture?' Binet locates the test in year XV and Terman and Burt both in year XII. The correlation of the test with mental age is 0.84.

XII, Alternative 1. Vocabulary, thirty words. (*Both in Kannada and Marathi lists.*)

TEXT AND PROCEDURE

Same as in IX, Alternative test.

XII, Alternative 2. Repeating Six Digits. (*1 out of 3. Read one per second.*)

TEXT AND PROCEDURE

The series for this year is:

3-7-4-8-5-9; 5-2-1-7-4-6; 4-7-1-5-8-2.

Procedure same as in the 'digit' tests of previous years.

XII, Alternative 3. Comprehension, Fourth Degree. (*2 out of 3. Repeat questions after 5 seconds. Time* $\frac{1}{2}$ *minute.*)

TEXT AND PROCEDURE

(*a*) 'What ought you to say when someone asks your opinion about a person you don't know very well?'

(*b*) 'What ought you to do before beginning something very important?'

(*c*) 'Why should we judge a person more by his actions than by his words?'

Procedure as in VIII, 3.

Remarks. These are the three most difficult of the Binet comprehension questions. They were separated by Terman out of the whole lot and located in year X. We found them difficult enough for year XII, even a little too difficult here. Burt places them in year XI. The correlation of the test with mental age as determined by the scale as a whole is 0.85.

CHAPTER XVII

TESTS FOR YEAR XIV

XIV, 1. Induction test: Finding a Rule. (Gets rule by sixth folding. Unfold and show the paper to the child after he gives his answer to each cutting.)

TEXT AND PROCEDURE

Cut out small pieces from old newspapers or blank sheets about 6 in. × 9 in. in size. Take one of these and say to the child,

'Now watch what I do.'

Then fold it once and in the middle of the folded edge cut out a small triangular notch with a pair of scissors. Then say,

'How many holes will there be in the paper when it is unfolded?' After the answer, whatever it may be, unfold the paper and hold it up for the subject's inspection.

Then take another piece, fold it once as before and say,

'Now, when we folded in this way and tore out a piece, you remember it made one hole in the paper. This time we will give the paper another fold. Now how many holes will there be?' With the third piece of paper say,

'When we folded it this way there was one hole and when we folded it this way there were two holes. Now, I am folding it again. How many holes will it have this time when I unfold it?'

Recapitulate every time, as for example with the sixth hole, as follows:

'When we folded it this way there was one hole, when we folded it again there were two, when we folded it again there were four, when we folded it again there were eight, when we folded it once again there were sixteen; now tell me how many holes there will be if we fold it once more.'

After the answer unfold the paper in the child's presence as usual. Take care that in the formula the words 'once,' 'twice,' 'thrice,' etc., as 'When we folded it once,' 'When we folded it twice,' etc., are not used as they may help and sometimes misguide the children. Leave them free to get their own rule. After the child's final correct answer to the sixth fold, say,

'How did you get it?' This question should not be asked before the sixth fold, though the previous answer may be correct.

For a pass the rule must be correctly stated.

Remarks. This test was suggested by Binet's 'paper-cutting' test and was first standardized by Terman in 1914. It is a fairly good test of intelligence with a correlation of 0.61 with mental age as determined by the scale as a whole. School instruction has no effect on it. It is also a test that arouses to a high degree the interest and curiosity of children. The only disadvantage in it is that it is likely to be communicated to others. It is more easily remembered than many of the other tests by the subjects that have undergone it, no doubt on account of its concrete nature and the interest that it arouses in them.

This test forces the child to use the trial and error method in an intelligent manner. The trial and error is not simply a blind trial with any numbers whatsoever but it seeks to discover a rule. The most common type of reasoning used by children in this test is: 'one'; 'two'; 'three'. He finds this incorrect and probably reasons out that the correct number four is obtained by omitting one number in the middle; thus he is led to say 'six' next and again finds this incorrect. Intelligent children generally find the rule here, namely, the next number is obtained by doubling the previous one; but some children still go on and say 'twelve' next. After this, normal children of this age usually get the rule but there are still some who give 'twenty-four' as the next number.

Very few children try the method of visualizing the folds and creases and reasoning out the number of holes by the deductive method. This deductive method is therefore not the natural method with children.

Terman places the test in year XIV. Our statistics find it a little too difficult for year XII, and easy enough for year XIV, in which year we have placed it.

XIV, 2. Dissected Sentences. (2 out of 3. 1 minute each.)

TEXT AND PROCEDURE

Use the card with the following disarranged sentences on it:

(*a*) to asked paper my teacher correct I my

(*b*) a defends dog good his bravely master

(*c*) for the started an we country early at hour

Place the printed card before the child, leaving the first sentence open and covering the remaining with cardboard or a sheet of paper. Say to him,

'Here is a sentence that has the words all mixed up so that they don't make any sense. If the words were changed around in the right order they would make a good sentence. Look carefully and see if you can tell me how the sentence ought to read.'

If within one minute the child cannot solve the problem, simply read out the correct order to him pointing to each word as you read.

After the child gives the rearranged sentence always read out to him the sentence as he has given it and ask him finally,

'Is that right?'

If the child misunderstands and adds new words, which is, however, very rare, say to him, 'No outside words are to be added,' and give him a fresh trial.

Otherwise no supplementary questions of any kind or explanations are allowed. Then give the second and third sentence, each time covering the rest with a sheet of paper.

Remarks. The sentences are arranged in order of difficulty as we found them. In translating the sentences into the Indian languages we have retained the original sense as far as possible and have obtained the same number of words in each sentence as in Terman's version. Burt's translation however differs from Terman's in the arrangement of words and in one case in the number of words also. For example, the first sentence contains eight words according to Terman's, Burt's and our versions.

Our arrangement of words is very nearly the same as Terman's, but Burt's arrangement differs. The second sentence contains seven words according to Terman's, Burt's and our versions, and our arrangement of words is very nearly the same as Terman's; but Burt's arrangement differs. The third sentence contains nine words according to Terman's version and ours, but only eight words according to Burt. In this sentence, however, in our version the sense had to be changed a little thus adding some new ideas in order to keep the number of words the

same. Consequently the arrangement of words also is a little different from Terman's. Burt uses the word 'morning' for Terman's 'early hour'. Burt's arrangement of words is also different as in the other sentences. The test is located in year XII by Binet (1911), Terman, Burt and Bobertag. Our statistics find it a little too hard for year XII, and so we have placed it in year XIV, as does also Saffiotti.

In assessing the answers any arrangement of words that makes good sense and is in common use is correct. In Indian languages the cases of nouns are made by inflecting the words themselves. Thus by merely looking at the nouns it is possible to pick out the subject. But children generally do not look to grammatical forms in rearranging the words. The *meaning* is the governing principle. They concentrate on making good sense; for example, in the Marathi version of the first sentence the words '*mâzyâ*' and '*mâzâ*' are used indiscriminately with '*shikshakânâ*' and '*pareekshechâ*'. We score both ways plus.

All workers agree in saying that this is one of the best tests of the series. Its correlation with mental age as determined by the scale as a whole is 0.88. The percentage of passes steadily increases with age. It is easy to give and easy to score; it does not take much time; it interests the child. It is of the type of 'completion' tests and it requires the child to rearrange the words so as to complete the sense. Certain key-words serve as a clue and lay down the skeleton of the sentence. This skeleton is to be given flesh and blood by rearranging the words properly.

In the procedure we have laid down that the sentences as given by the child should invariably be read out to him. This is quite necessary as the exercise is oral and even intelligent children sometimes may forget what they have said. When we read it a second time we are sure that the child has done his best and has not made a mistake merely out of chance.

XIV, 3. Arithmetical Reasoning. (2 out of 3. 1 minute each.)

TEXT AND PROCEDURE

Use the card with the following arithmetical problems printed on it:

(*a*) If two pencils cost 5 annas, how many pencils can you buy for 50 annas?

(*b*) If a man's salary is Rs. 20 a week and he spends Rs. 14 a week, how long will it take him to save Rs. 300?

(*c*) At 15 annas a yard, how much will 7 feet of cloth cost?

Place the card before the child and hide from view all except the first problem. Point to the first problem and say,

'Read this aloud for me.'

Help him if he cannot read some of the words. After he finishes say,

'Find me an answer to this.'

The subject must not use paper and pencil and the answer must be given within one minute.

For a plus, two of the three answers must be correct. Correct procedure without a correct answer is of no use. No second attempt is allowed. However, if the child corrects himself spontaneously he should be allowed to do so, provided the time limit is not exceeded. The answers are correct even if they are not converted into values of higher denominations.

Remarks. This is the second test in which simple arithmetical problems are used as tests of intelligence, the first being IX, 2, Making Change. At first sight these problems appear to be too simple for the age and many teachers whose opinions were sought agreed but when they are actually standardized this is the result. In IX, 2 the processes involved are simply addition and subtraction. In this year they are mostly multiplication and division. The figures to be manipulated are small and the problems simple and straightforward. Such processes are often met with in daily life by children and by adults who have not had much schooling. In school, children of these ages learn much more complicated processes. It is not, therefore, the processes themselves but their applications that tax the intelligence. Backward children use the process of multiplication where simple addition ought to be used and so on. Hence these tests serve as very good tests of intelligence. The present test shows a steady increase in the percentage of passes as age increases and has a correlation of 0.77 with mental age as determined by the scale as a whole.

The test was standardized by Terman. He selected the problems from Bonser's *Study of the Reasoning Ability of Children in the Fourth, Fifth, and Sixth School Grades.* Our location of the test agrees with Terman's.

XIV, 4. Problems of Enclosed Boxes. (3 out of 4. ½ minute for each problem.)

TEXT AND PROCEDURE

The problems are:

One large box containing (*a*) 2 smaller, 1 inside of each;
(*b*) 2 smaller, 2 inside of each;
(*c*) 3 smaller, 3 inside of each; and
(*d*) 4 smaller, 4 inside of each.

Show the child a small cardboard box about 3 in. by 2 in. by 1 in. in height without opening the lid and say,

'You see this box; it has two smaller boxes inside of it, and each one of the smaller boxes contains a little tiny box. How many boxes are there altogether, counting the big one? First the large box, then two smaller ones, and each of the smaller ones contains a little tiny box,' The second time say,

'Suppose now this box has two smaller boxes inside, and each of the smaller boxes contains two tiny boxes. How many altogether? Remember, first the large box, then two smaller ones, and each smaller one contains two tiny boxes.'

Similarly, the third time say,

'Three smaller boxes, each of which contains three tiny boxes.'

The fourth time say,

'Four smaller boxes, each containing four tiny boxes.'

The problem is given orally and solved by the boy also orally, that is, without the aid of paper and pencil.

Remarks. This test was devised and standardized by Terman. He places it in year XVI, but our statistics show that it is easy enough for year XIV; even a good many fairly intelligent children between 10 and 12 years of age pass the test. It correlates fairly well with mental age as determined by the scale as a whole; the correlation being 0.61.

For success in it the test requires either visual or tactual imagery, or both, of a high order. It is doubtful how far verbal imagery alone would solve the problems. Mentally backward children are unable to build mental structures of a very complicated nature; the child has to comprehend the instructions and

as they are being given the mental picture is being added to and held firm until it is completed. In this respect the test differs a good deal from the other tests in the scale and deserves a place in it.

XIV, 5. Giving Similarities—three things. (3 out of 5. 1 minute each.)

TEXT AND PROCEDURE

The following are the sets of words for this age:

(*a*) Wool, cotton, silk.
(*b*) Snake, cow, sparrow.
(*c*) Book, teacher, newspaper.
(*d*) Scissors, pice, piece of wire.
(*e*) Rose, potato, tree.

See IX, 3.

Give full formula:

'I am going to name three things, etc.' in the beginning. With the rest say,

'In what way are — — — alike?'

Sometimes the child says they are not alike and does not want to make an attempt. Then say,

'These three *are* alike. Tell me in what way they are alike.'

A fairly common way of giving similarity with many children is to say,

'They are all useful.'

Then say,

'In what way are they all useful?'

Any kind of real likeness is enough.

Remarks. This test is similar to IX, 3, (which see) except that similarity between three things is required instead of two. The best way of giving the similarity is to put them in the higher class of objects logically. But such a direct and rigid classification need not be expected from children of this age. Any indirect way of classification or any method of showing resemblance is enough.

Terman sets no time limit to this test. But we are of the opinion that a time limit is a great help in this test because if for nothing else it helps the examiner to know when to proceed to

the next item. It is useless to wait more than one minute for the answer. Instead of 'knife-blade, penny, piece of wire', we have used 'scissors, pice, piece of wire'. The rendering of 'knife-blade' into the Indian language is clumsy; and the use of knife-blade, being only a part of an object, is undesirable. Again we have 'wool, cotton, silk' instead of Terman's 'wool, cotton, leather' as leather is not used for as many purposes in India as in Europe even including its use for shoes.

The test shows a steady rise in the percentage of passes from year to year and it has a high correlation with mental age, the correlation being 0.88.

XIV, 6. Ball and Field, Superior Plan.

TEXT AND PROCEDURE

Same as in VIII, Alternative 2.

For help in scoring see sample card of answers.

XIV, Alternative. Vocabulary, forty words from vernacular lists.

TEXT AND PROCEDURE

Same as in IX, Alternative test.

CHAPTER XVIII

TESTS FOR YEAR XVI (AVERAGE ADULT)

XVI, 1. Interpretation of Fables (8 marks.)

TEXT AND PROCEDURE

Same as in XII, 5.

XVI, 2. Reversing Hands of Clock. (2 out of 3. Error must not exceed 3 minutes. Time limit 1 minute.)

TEXT AND PROCEDURE

Before giving the test see that there is no watch or clock within the child's sight. Say,

'Suppose it is six twenty-two o'clock, that is, twenty-two minutes after six; can you see in your mind where the large hand would be and where the small hand would be?'

'Now, suppose that the two hands were to change places, so that the large hand takes the place of the small hand, and the small hand takes the place of the large hand. What time would it then be?'

Similarly with 11-10 and 2-46.

The range of answers for the first problem is 4-30 to 4-35, for the second 1-53 to 1-58 and for the third 9-10 to 9-15.

Generally a child of this age knows how to read clocks and watches. If there be doubt, test actually by making him read your watch accurately. If he happens not to know, drop the test and substitute one of the alternative tests.

Remarks. The answer is generally given by children in half a minute. Terman allows two minutes. We have allowed one minute and this is enough. The position 8-10 is very clumsy. If it were made 8-13, the answer would be 2-41 and not 1-42 as with 8-10. The difficulty and nature of the test would, therefore be changed a little, and so we have changed it to 11-10, the answer to which is 1-56 and the nature of the test is retained as it was, at the same time, removing the clumsiness of 8-10.

The test is given by Binet in his 1905 series though omitted in those of 1908 and 1911. As the 1905 series was not an age

scale, the age where this test fits is not indicated. Terman locates it in year XIV. Goddard and Kuhlmann use only two of these sub-tests, the (*a*) and the (*c*) above, omitting (*b*) probably on account of its clumsiness, as we have shown. They want both problems to be correct and locate it in year XV. Our statistics show that the test is a little too difficult for year XIV, and so we have placed it in year XVI.

This test is a very valuable problem in constructive imagination of the visual type. It requires the child first of all to create a mental picture of the given position of time and then with the help of it to construct another picture with the hands changed. Both pictures do not appear to remain in attentive consciousness at one and the same time. After the first picture is formed and the second is being constructed, the first is momentarily wiped off, but again reconstructed several times for comparison, attention oscillating from one to the other as many times as it is necessary to solve the problem. This is no mean feat of mental gymnastics. The test correlates highly with mental age as determined by the whole scale, the correlation being 0.82. The percentage of passes rises gradually from year to year but is not very high even in the highest age. A little less than 40 per cent of the children between 12 and 14 years of age pass the test, about 51 per cent of those between 14 and 16 and 59 per cent of those above 16 years of age.

XVI, 3. Giving Differences between Patil and Kulkarni. (2 out of 4 in any form—1 Writing work, 2 Settlement of disputes or supervision of village, 3 Power, and 4 Appointment and tenure.)

TEXT AND PROCEDURE

'You know a Village Patil and you know a Village Kulkarni. Now give me any real and main difference between them that you know of.'

If the child gives only one or two differences or some trivial differences and stops, say, 'Any differences will do. Give me any differences that you know of.'

For success two of the following four in any form and even though mixed together are sufficient:

Village Patil	Village Kulkarni
1. Has no writing or account work.	1. Has writing and account work.
2. Has settlement of disputes or supervision of village.	2. Has no such work
3. Is a superior officer (power).	3. Is subordinate to the Patil.
4. Does not require much literacy and the post is generally hereditary.	4. Has, as a rule, to pass a literary test, and the post is not generally hereditary.

There may be small differences in these items on account of local circumstances and these should be taken into account in scoring.

Remarks. The Binet test of 'giving three differences between a President and a King' is unsuitable in India. Indian children have almost no knowledge of a President and only indirectly of a King. We had, therefore, to substitute for it a similar test but suitable for Indian conditions. Two such were tried, (1) 'The differences between a Collector and the President of a Municipality', and (2) 'The differences between a Village Patil and a Village Kulkarni'. Of these, the latter seemed to be better as most children come into contact with the Village Patil and the Village Kulkarni and a much smaller number with the Collector and the President of the Municipality. The first would give a slight advantage to town children, while the second would give the advantage to village children. As most of the tests in the scale give a slight advantage to town children, it was thought a slight advantage to village children in this test was desirable. The test does not depend much on schooling. There is a lesson on the Patil and the Kulkarni in one of the primary reading books, but that lesson is read by children at an age when they are not expected to know the full implications of the statements made in it. The children were, therefore, found to be thrown entirely on their own resources and began to *find* the differences from what they knew of the Patil and the Kulkarni. The test is found to be a fairly good test of intelligence, the correlation between it and mental age as determined by the entire scale being 0.58. There are very few children of this age in large cities who do not know about a Patil and a Kulkarni.

If one is found the test may be dropped and one of the alternative tests substituted in its place.

Psychologically the test is similar to other tests for finding differences and similarities, because finding similarities presupposes knowledge of dissimilarities. Compare, for example, VII, 6; IX, 3; XIV, 5; XIX, 3.

XVI, 4. Repeating Six Digits Reversed. (1 out of 3. Read 1 per second.)

TEXT AND PROCEDURE

Use the series:

4-7-1-9-5-2; 5-8-3-2-9-4; 7-5-2-6-3-8.

Procedure same as in similar previous tests. See VII, 3; IX, 1; XII, 4.

Remarks. In 'digit' tests a lower series should always be tried before a higher series is given.

XVI, 5. Problem Questions. (2 out of 3. Query on (a) and (b). Read a second time after 5 seconds. Time limit 1 minute to begin reply.)

TEXT AND PROCEDURE

Say,

'Listen carefully, and see if you can understand what I read.'

Then read the following passages twice over as indicated above one after the other slowly and emphasizing the keywords so as to make the meaning clear.

(*a*) 'A man who was walking in the woods of ....[1] outside this town stopped suddenly, very much frightened, and then ran to the nearest policeman, saying that he had just seen hanging from the limb of a tree a ... a what?'

(*b*) 'My neighbour has been having strange visitors. First a doctor came to his house, then a lawyer, then a clergyman (or priest). What do you think happened there?'

(*c*) 'A villager who had come to town for the first time in his life saw a man riding along a street. As the man rode by, the

[1] Use an appropriate name of a forest near the town.

villager said: "This man is lazy; he walks sitting down". What was that man riding on that caused the villager to say, "He walks sitting down"?'

Examples of satisfactory and unsatisfactory answers:

(*a*) Satisfactory. A man who hanged himself; suicide.

Unsatisfactory. A snake; a ghost; a nest of birds; a thief was running away after committing a theft, hanged himself on the branch of a tree; a monkey; adventitious roots of a banyan tree; a thief; a bat; the tail of a monkey; a cat; a bag; a honeycomb; a tiger; a bundle of clothes hung in the dark; some wonderful thing; a fallen trunk of a tree; a thief about to jump down; a bird; a fruit; mangoes.

(*b*) Satisfactory. Illness resulting in death—doctor to give medicine, lawyer to settle money-matters, priest to perform religious rites. Somebody is dead—doctor to see if he is dead, lawyer to settle disputes about division of property, and priest to perform funeral rites. Somebody is ill and the doctor comes; then he is about to die and the lawyer comes to make a will; finally he dies and the priest comes to perform the funeral rites. Murder—doctor for post-mortem, lawyer to note down facts of the case, and priest for funeral rites. Some accident—doctor to examine the dead man, lawyer in order to conduct the case, and the priest for funeral rites. Somebody is poisoned—doctor for medical examination, lawyer to note down the law-points and the priest for the funeral rites. Somebody recovers after serious illness—doctor to give medicine, lawyer to take the patient's signature and priest for feast after recovery. Somebody is ill and then dies—doctor for treatment, lawyer for management of property, and priest for purification of the household (*prāyaschitta*) and for receiving charity.

Unsatisfactory. Doctor for illness, pleader for some business, priest for some ceremony. Doctor for illness, lawyer to inquire about the cause of quarrel, priest for marriage ceremony. Doctor for illness—they might have come for a feast. Murder—no explanation. Doctor for illness, lawyer for quarrel, and priest for marriage.

(*c*) Satisfactory. Bicycle.

Unsatisfactory. A horse; a cart; a motor-car; a palanquin; a tonga; on foot; carrying another person; on the ground; a

bullock; a small animal; a lame man was seated on the ground and propelling himself along; a donkey; a calf.

Remarks. The first two problems are Binet's, the third is added by Terman. In the first problem Binet uses the name of a forest near the town where the subject is being examined. Terman omits this. Binet's form is better as it helps the child to visualize the events and makes the problem more concrete and definite. Binet requires the answers to both the problems correct; while Terman requires two out of three to be correct. Thus Binet's form of test is harder than Terman's. Binet locates this test in year XV of his 1911 scale. Burt with the identical form of test in year XIII, and Terman with the amended procedure in year XIV. Our statistics requiring two out of three problems correct would place the test in year XVI. The test is a fairly good test though many children hazard an answer by mere guessing. The correlation of the test with mental age as determined by the entire scale is 0.8.

The test requires the child to visualize elements and discover a situation where all these elements will fit in. It is thus psychologically a form of the completion test of the abstract type. It is interesting how many children's answers reveal the strong power of perceptual associations, which children are powerless to inhibit, and are unable to find out a proper solution by reasoning. Thus in the first problem a great many answers give 'a bat'. The children have seen these bats hanging from the branches of trees and as soon as they try to visualize anything hanging from the branch of a tree, the previous association formed brings up the image of a bat. Similarly in the third problem when we translated 'a white man' by 'a European' in the Indian language the answer invariably was 'a motor-car', because Indian children have usually seen Europeans 'riding' in a motor-car, and when the words 'European' and 'riding' are given, the association brings in 'a motor-car'. After a little trial we were obliged on this account to change the phrase 'a European' into simply 'a man'. These instances exemplify the great power of perceptual images to occupy the mind and inhibit thinking, which is necessary in finding out a situation in which the given elements will fit. The fixity of the imagery is thus a sign of low intelligence. Higher intelligence can construct and destroy imagery very rapidly. In a good many cases a plausible answer is first given

and then some sort of explanation is manufactured, particularly in (*b*).

Binet and Terman did not time the problem, nor did they lay down how many times the problems should be re-read. The greater the number of times the passages are read, the greater the chances of backward subjects finding an answer. Similarly we cannot be indefinitely waiting for a reply, and so we have for the sake of uniformity thought fit to time the test and lay down the procedure accurately.

If the test is scored on the basis of two out of two (both Binet's, i.e. the first two) after Binet it is harder still and would be suitable for the Superior Adult group according to our statistics.

XVI, 6. Repeating Seven Digits. (1 out of 2. Read 1 per second.)

TEXT AND PROCEDURE

The series is:

2-1-8-3-4-7-9; 9-7-2-8-4-6-5.

Procedure same as in previous 'digit' tests.

Remarks. If the test is scored on the basis of 1 out of 3, it is slightly easier and is suitable for year XIV. Terman has the same digits, namely 3, twice in the first series and 7 twice in the second series. This sometimes disconcerts the child and diverts his attention. He sometimes interrupts and says the digit occurs a second time, and so the test is spoiled. We have changed this.

XVI, Alternative 1. Vocabulary, forty-five words.

TEXT AND PROCEDURE

Same as IX, Alternative test.

XVI, Alternative 2. Free Association, sixty words in three minutes.

TEXT AND PROCEDURE

Same as in IX, 6.

CHAPTER XIX

TESTS FOR YEAR XIX (SUPERIOR ADULT)

XIX, 1. Using a Code. (Vernacular codes to be used. 2 errors. 6 minutes. Inverting numbers or writing one of the numbers of a letter counts half error. But if all the numbers are inverted and the message is otherwise correct no errors are to be counted.)

TEXT AND PROCEDURE

Place before the subject the card on which the code is printed and say,

'See this secret code. You will see from this that you can write any syllables in the same way. Now, examine the method of writing syllables carefully. To illustrate, first the words "Go to school" (in Kannada) are written here in ordinary script and the same again in the secret code. The first syllable (in the Kannada script) is the seventh of the class of consonants beginning with.... Therefore, we write the first consonant ... and the number 7 beneath it. Thus ... means.... Further, the first syllable ... is the second in order in the series of syllables. ... Therefore, we write the number 2 above. Thus ... means the first syllable.... Similarly, the last syllable, etc., etc.

'Now, I will give you half a minute. In that time you must study this code carefully without speaking a word. Then I will take away the card and ask you to write something for me in this secret code. Now look at this.'

After the half minute say,

'Now you must write something for me. Remember how you are to write it. When you have to write a syllable look to the class of consonants to which it belongs. Then write down the first of these and *below* that put the serial number of the required consonant in that class; then write the number of the required syllable in the series of syllables *above* the letter.'

Then remove the card from the sight of the subject and say,

'Now write the words ... in this code.'

Remarks. The English code test was devised by Healy and Fernald and appears in their *Tests for Practical Mental Classification*, published in 'Psychological Review Monographs', 1911.

It was first standardized and located in year XV by Dr Goddard and then by Terman in his Stanford revision and located in year XVI (Average Adult). As the Indian scripts are quite different a new code test had to be devised for this script.

The results of this test, therefore, cannot be compared with those of the English code, since there is very little in common between them except the name. This code appears to be simple at first sight but when actually put to the test it is found to be too difficult for the Adult group but is suitable for the Superior Adult group. Psychologically it requires the subject to put into use the highest conceptual processes of analysis and synthesis. The power of comprehending verbal statements is also a great factor. The directions are rather long, but the instinct of 'curiosity' keeps up the interest of the subject.

In the directions we have stated that if the subject inverts all the digits no error is to be counted. The reason is that it is natural for us not to remember without much drilling which of two alternatives is correct, just as children find it very hard to remember 'right' and 'left' without drilling. Hence if the subject follows one of the alternatives to the logical end, no error is to be counted.

The consonants in the Indian languages are classified as the 'gutterals', the 'dentals', the 'labials', etc. These are called the *vargas* (classes). There are certain others which are grouped together in a heterogeneous mass and are called the *avargiyas*, the unclassed group. But for simplicity in giving directions we have called this group the *ya-varga*, which is really an inaccuracy, but excusable for the sake of convenience.

The test shows a high correlation with mental age as determined by the scale as a whole, namely 0.89. More than 36 per cent of children between 14 and 16 years of age pass it and nearly 40 per cent of adults, i.e., subjects above 16 years of age.

XIX, 2. Ingenuity Test. (2 out of 3. 5 minutes each. Directions may be repeated. If the subject fails on the first, experimenter explains it.)

TEXT AND PROCEDURE

Say to the subject,

(*a*) 'A mother sent her boy to the river to get seven pints of water. She gave him a 3-pint vessel and a 5-pint vessel.

Show me how the boy can measure out exactly 7 pints without guessing at the amount. Begin by filling the 5-pint vessel.'

The answer must be found orally. The subject must explain the complete solution. Tell him no marking of the vessel with chalk or some such thing is allowed. If the subject fails to give the solution within 5 minutes explain this problem and proceed to the next.

(*b*) Same as above, except that 5 and 7 are given to get 8. 'Begin by filling the 5-pint vessel.'

(*c*) Same as (*a*), except that 4 and 9 are given to get 7. 'Begin by filling the 4-pint vessel.'

Remarks. The test was devised and standardized by Terman. It is rather a hard test though at first sight it does not look so. Terman says; 'Only an insignificant number pass the test below the mental age of 14 years, and about two-thirds of Average Adults fail. Of our Superior Adults somewhat more than 75 per cent succeed.' Our statistics show that it is passed by 14 per cent of children between 12 and 14 years of age, 32.5 per cent of children between 14 and 16 years and 36 per cent of those above 16 years of age. The correlation of the test with mental age is 0.65.

Psychologically the test requires a very high power of visual imagery. The vessels must be imagined and the operations of pouring the water, adding, subtracting, etc. must be done with these imaginary vessels. There is also an element of the trial and error process. The subject tries various processes and finds out which process leads to the required result.

The weakness of the test is that it is most likely to be communicated to other children. The problems can be easily remembered and being of a novel nature are something of the type of 'catch' questions that children take pleasure in asking others. When this is found to be the case the examiner should not use the test.

XIX, 3. Differences between Abstract Terms. (3 out of 4. Wait 1 minute for reply.)

TEXT AND PROCEDURE

'What is the difference between

(*a*) Laziness and idleness?

(*b*) Pride and vanity?

(*c*) Poverty and misery?
(*d*) Dishonour and disrepute?'

If the subject simply gives the definition of the two words separately without pointing out the essential difference between the two terms, say,

'Yes, but I want you to tell me the difference between— and—. Tell me only the difference.'

Remarks. The selection of the proper pairs of words is very important here. There must be similarity of meaning and yet an essential difference between the two terms. Binet's pairs in his 1908 scale were:

(i) Pleasure and happiness.
(ii) Evolution and revolution.
(iii) Event and advent.
(iv) Poverty and misery.
(v) Pride and pretention.

He cuts these down to three pairs in his 1911 scale:

(i) Idleness and laziness.
(ii) Event and advent.
(iii) Evolution and revolution.

Burt, who otherwise follows Binet very closely, uses the first, second and fourth of the Binet 1908 pairs.

In selecting the pairs of words mere translation is of no use, because in the different languages the subtle differences in such pairs of words vary to a very large extent. Sometimes it is very difficult to find exactly parallel pairs. Further the difficulty of the pairs may vary much in different languages. Terman uses the following four pairs:

(i) Laziness and idleness.
(ii) Evolution and revolution.
(iii) Poverty and misery.
(iv) Character and reputation.

We have used four pairs in the Indian languages which are translated into English as nearly as possible as indicated above in the English version of our tests but not exactly. The fourth pair we tried at first was 'honour and reputation'. This raises some difficulties and we changed it later on into the contrary

terms 'dishonour and disrepute'. In giving differences any real clear contrast should be given. Giving the meaning of the terms only without bringing out the contrast is of no use.

This test appears in year XIII of Binet's 1908 scale and in the Adult group of his 1911 scale, in the forms we have indicated above. Terman has it in year XVI (Average Adult group). Burt locates it in year XV. We have found it difficult enough for the Superior Adult group.

This test taken along with XII, 3 'defining abstract terms' demonstrates clearly how our language ability evolves from year to year. While 'defining abstract terms' is found easy enough for year XII, 'finding differences between abstract terms' is difficult even for the Adult group. It is suitable only for the Superior Adult group. It is passed by 26 per cent of children between 14 and 16 years of age and by 41 per cent of the adult group, i.e. those above 16 years of age. It correlates well with mental age, the correlation being 0.78.

XIX, 4. Binet's Paper-cutting test. (*If given must come before XIV, 1. The creases must be shown in pencil and the diamond shaped holes in the middle of the two halves of one of these creases. 2 minutes to complete drawing.*)

TEXT AND PROCEDURE

Take a piece of paper as stated in XIV, 1 and say,

'Watch carefully what I do. See, I fold the paper this way' (folding it once over in the middle) 'then I fold it this way' (folding it again in the middle, but at right angles to the first fold). 'Now, I will cut out a notch right here.' So saying cut out a triangular notch in the middle of the single edge where there are no separate leaves.

Then leave this folded paper with the notch exposed to view, but pressed flat against the table. Give the subject a pencil and another piece of paper similar to the one used and say,

'Take this piece of paper and make a drawing to show how the other sheet of paper would look if it were unfolded. Draw lines to show the creases in the paper and show what results from the cutting.'

If the paper is not square but a little longer one way, the holes may be either on the longer creases or the shorter. But their

number and position in the middle of the two halves of the creases must be correct. The exact shape and size of the holes are not taken into account. The child must not fold the paper given to him before drawing.

Remarks. As Terman remarks, this test requires the power of constructive visual imagination. The child has successively to construct visual images of the piece of paper, the first folding and the creases so formed, then the second fold, the creases so formed and the holes made by the cutting. This is a highly valuable test for higher ages, for which it is very difficult to get suitable tests. The correlation of the test with mental age is 0.63. Nearly 28 per cent of children between 14 and 16 pass it and only 32 per cent of those above 16.

Binet located this test in year XIII in his 1908 scale and in the Adult group in his 1911 series. Terman locates it in the Superior Adult group and Burt in year XV.

XIX, 5. Repeating Thirty Syllables. (1 out of 2 absolutely correct.)

TEXT AND PROCEDURE

The following are the renderings of the Marathi passages to be given for repetition in this year.

(*a*) Rama likes very much to go to his grandmother, because she tells him funny stories.

(*b*) Yesterday I saw a pretty little dog in the street. It had curly brown hair.

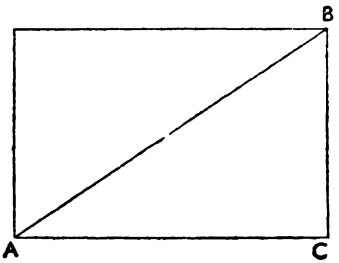
Procedure as in previous repetition of syllables tests. Note that in this year one of the two passages must be absolutely correct.

Remarks. Binet's corresponding test is of 26 syllables and he locates it in year XV in his 1911 scale. Burt locates it with the same number of syllables in year XIV. Terman uses 28 syllables and places it in year XVI or Adult group. Binet and Burt allow only one trial, while Terman gives two trials. We have used 30 syllables with two trials and find it difficult enough for the Superior Adult group. The test is passed by 25.5 per cent of children between 14 and 16 years of age and by 30.5 per cent of those above 16 years, that is, the Adult group.

The correlation of the test with mental age is 0.68. But when all the tests of repeating syllables are correlated together with mental age the correlation is 0.89.

XIX, 6. Reversing Triangle in Imagination. Karnatak form. (Time to complete diagram 2 minutes.)

TEXT AND PROCEDURE



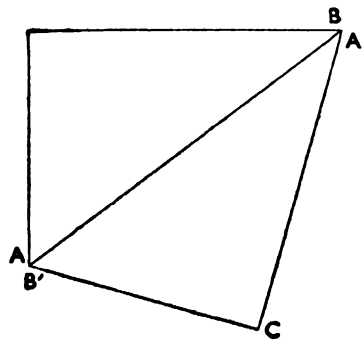
Place a stiff white card 6 in. by 4 in., divided along the diagonal AB as in the 'divided card' test (VI, 3), before the child, with the cut edges joined together as shown in the diagram above, the side AC being towards the child (the letters A B C are not to be shown). Then say,

'Look carefully at the lower piece of this card (pointing to it). Suppose I now turn it over (showing the turning movement with the hand without removing the piece) and place this corner of the lower piece (pointing to B of the lower piece) touching this corner of the upper piece (pointing to A of the upper piece); and this corner of the lower piece (pointing to A of the lower piece) touching this corner of the upper piece (pointing to B of the upper piece). What would it all look like? Now I am going to take the piece away (remove at this point the lower triangle only from view). Imagine it placed as I told you; and draw its shape in the proper position. Begin by drawing the shape of the top triangle.'

The finished diagram as drawn by the subject should be as shown on the opposite page.

The essential points to be remembered in scoring the diagram are: (1) the figure should be roughly symmetrical about the diagonal; (2) the ends A, B, and B′, A′ should be congruent; (3)

the angle C should be roughly a right angle. Note that (2) and (3) are included in a way in (1).



Remarks. This test was suggested while giving Binet's test of 'reversing triangle in imagination', which was found to be too hard even for the Adult group. Even this test was found to be too difficult for the Adult group. Statistics showed that the present test was suitable for the Superior Adult group and Binet's original test was hard enough for the Very Superior Adult group. The present test is passed by 28 per cent of adults and Binet's test by 4 per cent of them. The correlation of the test with mental age is 0.55.

XIX, Alternative. Vocabulary, fifty-five words.

TEXT AND PROCEDURE

Same as in previous vocabulary tests.

Remarks. With increase in mental age not only does the quantity of the vocabulary, that is the number of words known, increase, but also its quality. The definitions of words given by this class are generally accurate, even abstract words being defined accurately.

CHAPTER XX

TESTS FOR YEAR XXII (VERY SUPERIOR ADULT)

XXII, 1. Comprehension of Physical Relations. (2 out of 3. May read a second time if necessary.)

TEXT AND PROCEDURE

(*a*) Problem regarding the path of a cannon ball.

Draw on a piece of white paper a long horizontal line from end to end, towards the bottom of the paper. Above it at a distance of about two inches and at the left end of the paper from the subject's side draw a short line about an inch long parallel to the first line.

Say to the subject,

'Suppose this long line is a level piece of ground and this short line is a gun which is placed horizontally parallel to the ground and is fired across this perfectly level piece of ground.

'Now, suppose that this cannon is fired off and that the ball comes to the ground at this point here. (Making a small mark at the farther end of the line which represents the level ground.) Take this pencil and draw a line which will show what path the cannon ball will take from the time it leaves the mouth of the cannon till it strikes the ground.'

As Terman says the answers may be classified as follows:

(1) A straight line is drawn joining the mouth of the cannon and the point where the ball strikes the ground.

(2) A straight line is drawn from the mouth of the cannon to a point almost directly above the point where the ball strikes and then this line drops suddenly to the goal.

(3) The line rises gradually from the mouth of the cannon and then descends down to the goal, thus making something like a parabolic curve.

(4) The line goes horizontally from the mouth of the cannon for some distance and then descends gradually to the goal.

Of these the fourth type of answer is the only one that is satisfactory. It need not, however, be mathematically accurate.

(*b*) Problem about the weight of a fish in water.

Say to the subject,

'You know, of course, that water holds up a fish that is placed in it. Well, here is a problem. Suppose we have a bucket which is partly full of water. We place the bucket on the scales and find that with the water in it it weighs exactly 45 pounds. Then we put a 5 pound fish into the bucket of water. Now, what will the whole thing weigh?'

Even though the answer may be correct ask further,

'How can this be correct, since the water itself holds up the fish?'

The response is correct when the subject says (1) The weight is 50 pounds; (2) persists in this answer after the second query, and (3) gives some sort of plausible explanation like the following: The weight is there any way; the weight of water and the weight of fish both press down the scale pan.

(*c*) Difficulty of hitting a distant mark. Say,

'You know, do you not, what it means when they say a gun "carries 100 yards"? It means that the bullet goes that far before it drops an appreciable amount.

'Now, suppose a man is shooting at a mark about the size of a petroleum tin. His rifle carries perfectly more than 100 yards. With such a gun is it any harder to hit the mark at 100 yards than it is at 50 yards?'

If the subject answers in the affirmative ask him to explain. The correct explanation is that a small deviation from the correct direction at the start becomes larger and larger as the distance is increased. The mathematical relation of this increase of deviation to distance is not required. It is enough if the subject gives only the general principle. The subject will have to be questioned a little until he understands what exactly is required.

Remarks. One feels rather uneasy in giving this test. It is found too hard for the Average Adult group and even a little too hard for the Superior Adult group. We have, however, retained it in the Very Superior Adult group as it is so difficult to get good tests for the highest intelligence. It is passed only by about 7 per cent of subjects above 14 years of age and by 10 per cent of the adult level. Our statistics in this respect are very disappointing as compared with Terman's. Terman says:

'At the 14 year level less than 50 per cent pass; of Average Adults from 60 to 75 per cent are successful. Few Superior Adults fail.' The correlation of the test with mental age is 0.75.

The test seems to depend a good deal on acquired information. Two of the three problems are concerned with shooting. Very few Indian children are conversant with any kind of shooting apparatus, even toy apparatus, with the result that they have no idea of the mechanism of the same or of the path of the projectile. Of course they do a good deal of stone throwing but their experiences with regard to the path of the stone are very vague, and the test is consequently found to be very difficult for them. Psychologically, no doubt, it does require a good power of imagery but for the proper form of imagery to be roused the children must have had previous experience of the situations.

XXII, 2. Repeating Eight Digits. (*1 out of 3. Read one per second.*)

TEXT AND PROCEDURE

Give the digits with a uniform speed and without any rhythm or sing-song manner.

The series is: 7-2-5-3-4-8-9-6; 4-9-8-5-3-7-6-2; 8-3-7-9-5-4-2-6.

Remarks. The test is passed by 13.3 per cent of subjects between 14 and 16 years of age and by 7.2 per cent of those above 16 years, which shows that memory for digits falls off after the sixteenth year. The lower percentage of passes in the adult level of this as well as of the three following tests seems to support the view that immediate memory falls off after the sixteenth year. (See footnote to p. 60.)

XXII, 3. Repeating Thought of Passage Heard. (*Read the passage only once in about* $\frac{1}{2}$ *minute.*)

TEXT AND PROCEDURE

Say to the subject,

'I am going to read once only a little selection of about 6 or 8 lines. When I am through I will ask you to repeat as much of it as you can. It does not make any difference whether you remember the exact words or not, but you must listen carefully so that you can tell me everything it says.'

The subject's report should be taken down verbatim.

After securing attention the following passage should be read slowly—in about half a minute—and with expression, laying stress on the key words:

'Many opinions have been given on the value of life. Some call it good, others call it bad. It would be more nearly correct to say that it is mediocre, for on the one hand our happiness is never as great as we should like, and on the other hand our misfortunes are never as great as our enemies would wish for us. It is this mediocrity of life which prevents it from being radically unjust.'

The subjects generally try their best to give the substance of the passage but if they stop in the middle encourage them to say as much as they can remember, in whatever words they like.

The arguments in the passage should be carefully reproduced and should contain the following three ideas: (1) life is neither good nor bad (but medium); for (2) it (or our happiness) is not so good (or so great) as we wish it, nor (3) so bad as our enemies (or others) wish.[1]

Remarks. This is one of the most valuable tests in the series. It requires the subjects to comprehend the logical argument of a difficult passage, as it is being read, and to reproduce it. The selection is Hervieu's reflection on life and is an excellent one. This test differs from those of repeating syllables in that, in the former, the sense of the passage is more important than the words in which it is clothed; while in the latter the actual syllables are all important. Of course even in the latter the sense or meaning is a great help in retaining the syllables, since the child would be able to repeat far fewer nonsense syllables than syllables having sense. It differs from the test of reading and report in that in the latter the child himself reads and his ability to comprehend a passage that is received through visual impression is tested, while in the former his ability to comprehend a passage received through auditory impression is tested. But from this we cannot say that comprehension of a passage received through auditory impression is more difficult than comprehension of a passage received through visual impression. For such a comparison the passages must be of the same difficulty, but it is

[1] Cyril Burt, *Mental and Scholastic Tests*, p. 67.

far from so in the case of the present passage and the passage in IX, 5. The passage in IX, 5 is descriptive and concrete, while the present passage is reflective and abstract.

Binet assigns the test to the Adult group; Burt assigns it to year XVI. Terman gives one more passage and requires one of the responses to be correct. His second passage contains a good many scientific terms and cannot be easily translated into the Indian languages. We have retained only one passage, namely the original one used by Binet, as this was found to answer the purpose very well. Terman assigns it to the Superior Adult group, while we think it hard enough for the Very Superior Adult group.

Abstract thinking and the ability to form rapid imagery are no doubt signs of great intelligence. Lower intelligence requires concrete objects and concrete illustrations as an aid to thinking. This is a great lesson in education. In the earlier stages the teacher provides the child with models and diagrams, from which the child learns new things; but as the imaginative power of the child is developed, the use of such concrete objects is lessened. In later stages such models are used only when explaining the most intricate machinery.

The test is passed by 15.8 per cent of subjects between 14 and 16 years of age and by 13.3 per cent of those above 16. The correlation of the test with mental age is 0.82.

XXII, 4. Reversing Triangle in Imagination. Binet's form. (Time limit 2 minutes to complete the diagram.)

TEXT AND PROCEDURE

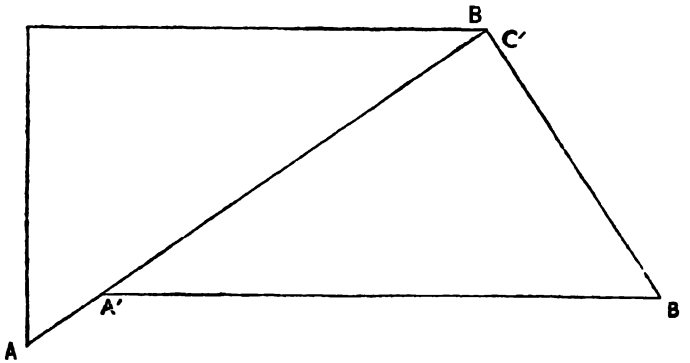
Procedure similar to XIX, 6.

After placing the divided card before the subject exactly as stated in XIX, 6, say,

'Look carefully at the lower piece of this card. Suppose I turn it over and lay this edge (pointing to line A C [see diagram on p. 231] without moving the card) along this edge (pointing to A B of the upper triangle); and suppose that this corner (pointing to C) is placed just at this point (pointing to B); what would it all look like? Now I am going to take the piece away. (Remove the lower triangle from view.) Imagine it

placed as I told you, and draw its shape in the proper position. Begin by drawing the shape of the top triangle.'

The finished diagram as drawn by the subject should be as follows (without the letters):



The essential points to be remembered in scoring the diagram are:—(1) A′ C′ B′ must be roughly a right angle. (2) A′ C′ must be shorter than A B; and (3) B′ C′ must be the shortest of the three lines.[1]

Remarks. This test is one of the hardest tests in the whole series. It does require a little geometrical knowledge, the differentiation of a right angle from an acute angle, for example. The test is found surprisingly enough to be too difficult even for adults. The subject is required to form an image of the figure of the triangle, lift it in imagination, and apply it as directed. This is certainly helped by a proper knowledge of the size of the angles. It would be of interest to see what percentage of unschooled adults would pass the test as compared with adults who have had a course of schooling. Our present statistics show that the test is passed by 9.2 per cent of children between 14 and 16 years of age and by 3.3 per cent of adults, i.e. those above 16 years of age. The correlation of the test with mental age is 0.83. The test is located in the Adult group by Binet (1911) and in year XV by Burt. It is dropped by Terman as an unsuitable test.

[1] Cyril Burt, *Mental and Scholastic Tests*, p. 67.

XXII, 5. Repeating Seven Digits Reversed. (1 out of 3. Read one per second.)

TEXT AND PROCEDURE

The series for this year is: 4-1-6-2-5-9-3; 3-8-2-6-4-7-5; 9-4-5-2-8-3-7.

Procedure same as in previous tests of repeating digits in reverse order.

Remarks. The test is passed by 10.8 per cent of children between 14 and 16 years of age and by 8.2 per cent of adults.

XXII, 6. Free Association, giving eighty words in three minutes.

TEXT AND PROCEDURE

Same as in IX, 6.

XXII, Alternative. Vocabulary, sixty words.

TEXT AND PROCEDURE

As in vocabulary tests of previous years.

APPENDIX A

A STUDY OF TYPICALLY MENTALLY DEFICIENT CHILDREN

Some time after the scale described in the body of this book was ready, the author had an opportunity of testing the backward children in the Children's Home, Umarkhadi, Bombay.[1] The statistics from this study are not taken into account in determining the scale. For, in the first place, this study was undertaken after the scale was ready, and secondly, children who are brought together from all parts of Bombay State do not properly form part of the population studied. It was a great pleasure, however, to study the mentality of children of the lowest levels and to have an opportunity of verifying the classification of children suggested on p. 84 of this book.

The children were tested either in Marathi or in Hindustani. Almost all the children knew Hindustani well. Although this scale is not standardized in Hindustani, the tests up to the age of eight are very simple and the character of the language does not play any great part in them, as can easily be seen by reference to the tests. The only tests that were not used, the wording in the new language not having been standardized, were the 'repetition of syllables' tests and sometimes the 'comprehension' tests. In place of these the alternative tests were used. As most of the children were mentally deficient there was hardly any occasion to use the tests beyond the eighth year. The scale thus worked very satisfactorily.

A few typical cases are described below. For obvious reasons the chronological ages of these children are only approximate. It will be seen that even at this low level each child is an individuality. One boy is very timid, another is very silent and docile, a third irritable and restless, a fourth a bully and so on. Very often also each child has some dominant idea, round about which his mind is always working. One child, for instance,

[1] The author is indebted to Miss B. Budden, Secretary, the Children's Aid Society, Umarkhadi, Bombay, for having made this study possible and for having given him all possible help.

always gives the name of his town or mother or father in response to any question put to him or when his attention cannot be drawn to the question. Another child goes on repeating some striking incident in his life, such as being beaten by his father or mother, or of having been burnt as a result of an accident. One boy, it was noticed, always said 'up, up' and 'climb up'. On inquiry it was found that the boy was in the habit of climbing up trees or house-tops and such places.

The instances given below are only of boys. There were some girls also in the study. Their behaviour did not differ visibly from that of the boys.

1. MOHID. (Chronological Age 9 years 11 months. Mental Age 6 years. Intelligence Quotient 60.5. On the borderline of Mental Deficiency.)

The boy has paralysis of the left side—face, arm and leg. His family history is not available. He said his father was a servant feeding horses, but could not give any address. He was at first sent to another Home, but as that Home had no walls, he ran away and was found by the police on Chowpatti seashore, Bombay. He is educable and takes interest in school work, but of course is very backward. He is slow and plodding, unemotional and never gets angry or cries. He is clean in habits, looks after himself in spite of his paralysed hand except that he needs help in bathing those parts of his body which he cannot reach on account of his not being able to raise his left hand above his head. At the time of testing he was attending the infants' class. The teacher later on reported that he was doing fairly good work and would not believe he was mentally so low. After a year he was sent for retesting. This time also he tested about the same level. The teacher did not understand that since his mental age was equal to the average mental age of the class in which he was placed, he did not find much difficulty. According to his chronological age he ought to do fairly well in a class four standards higher.

2. ABDULLA. (C. A. 7 years. M. A. 3 years 6 months. I. Q. 50. Moron.)

He is a good looking boy and is affectionate towards others. His parents could not be traced as the boy could give no information about them. He says his father makes bottles. He can look after himself, dress, bathe, etc. He is very quiet and has

Mohib
I Q 60 5

Abdulla
I Q 59

Murtaza
I Q 4[illegible]

Krishna
I Q 4[illegible]

Mahadev
I Q 36

Dami
I Q [illegible]

Naidu
IQ 50

Mallo (Madya)
IQ 26

Mohena
IQ 23

Sayyad
IQ 25

Lekya
IQ 8

to be protected from bullying by other children. He cannot speak distinctly. He repeats the word Malhar (his native place) very often, sometimes as an answer to any kind of question. He answered easily all the questions of year III and only 3 from year IV. He could not draw the square nor count 4 pice but answered correctly the comprehension questions of year IV. He can do a little simple woolwork, but is not fit for any kind of ordinary school work, even in the infants' class.

3. MISRI LAL. (C.A. 12 years 10 months. M.A. 5 years 6 months. I.Q. 43. Moron.)

He says his father is a shoe-maker, but cannot say anything about his brothers or sisters. He has scars on his forehead and left elbow. He gets epileptic fits, in one of which he fell into a fire and got his left arm burnt. The arm is thus permanently bent at the elbow. He gives slow and deliberate responses to questions. He can look after himself and manages to do simple woolwork even with one arm bent. He answered all the tests of fourth and fifth years and only 3 from the sixth year. He could draw the square correctly, but failed in the 'diamond' test. He could enumerate objects in the pictures, but could not describe them. He could repeat four digits correctly but could not put together the two halves of the divided card. He passed in the 'comprehension' tests of the fourth year, but failed in those of the sixth year.

4. KRISHNA. (C.A. 8 years 3 months. M.A. 3 years 9 months. I.Q. 42 Moron.)

His father is a mill-worker. The boy can look after himself. He sings and plays and is full of enthusiasm. He likes pictures. He does not look like a mentally deficient child at first sight. He never stays at home and always runs away. He is physically quite normal. He gets epileptic fits. He answered all the tests of the third year, one test from year IV and two from year V. He passed in the 'comprehension' test of year IV, but could not repeat three digits, nor count four pice. In drawing the square he could make only small irregular marks with the pencil. In the fifth year he could make æsthetic comparison and define words in terms of use but failed in carrying out three commissions (actions) and in distinguishing right and left.

5. MAHADEV. (C.A. 9 years 8 months. M.A. 3 years 6 months. I.Q. 36. Imbecile.)

His father does odd jobs as a coolie. The mother has fits of madness, during which she throws stones and becomes quite dangerous. The boy is very timid. He takes little mincing steps and is afraid to go up and down steps or walk along a plank one foot broad, raised three inches from the ground. He cannot be persuaded to do anything, such as sewing cards or colouring with chalk sticks. He takes no part in ball games. He had at first hardly any control over his bowels, but evacuated where he sat, as soon as he finished a meal. He has been trained to some extent towards better habits. He feeds but cannot dress himself. He is physically normal. He passed all the tests in year III, two in year IV, and one in year V. In the fourth year he repeated three digits correctly and answered the comprehension questions. He could not count four coins, and in copying a square he drew more or less straight lines. In the fifth year he could name the coins, but did not succeed in æsthetic comparison, definition in terms of use, carrying out three commissions, or distinguishing right and left.

6. DAMU. (C.A. 13 years 6 months. M.A. 4 years 4 months. I.Q. 32. Imbecile.)

The father of the boy is a Kunbi cultivator. As is generally the case with such unfortunate children, he is not anxious to have the boy, as he is not of any service to him. The boy can look after himself, and makes himself useful in the Children's Home, to which he is committed, by sweeping the room or premises and doing such other simple menial work. He also does some simple woolwork. He is quite tractable. He gives spasmodic shrieks now and then, when he bends his head and convulsively clasps his cheek very hard with both his hands. The cheek is thus permanently bruised. The police surgeon did not certify him as insane. He is docile, never disturbs other boys and never speaks unless spoken to. He seems to be quite conversant with railways and always speaks of the railway train. His responses to the pictures were of enumeration, and the prompt responses to the first picture were 'a railway train, a station'. He passed in all the third year tests, in five out of the six tests of the fourth year, in two tests of the fifth year and in one of the sixth. He counted four pice, but not thirteen. His drawings of the square were more or less round with one or two awkward attempts at making corners. He could define in terms

of use and knew the names of only three coins. He failed in the 'æsthetic comparison' test, in performing three commissions and in distinguishing right and left. Of the sixth year tests he passed only in repeating four digits.

7. NAIDU. (C.A. 14 years. M.A. 4 years 4 months. I.Q. 30. Imbecile.)

The boy can tell nothing about his family. He talks in a shrill cracked voice. His physical condition is normal. He can do the splitting and paring of cane for basketwork quite well. He looks after himself and is clean in his habits. He bullies smaller boys and flies into towering rages. His speech is not well developed and he answers all questions in single words. Thus his answers to the comprehension questions of the sixth year were correct, but in single words, namely, 'umbrella' for 'I will take an umbrella', and 'water' for 'I will pour water'. He answered correctly all the questions of the third year, three of the fourth year, two each in the fifth and sixth years and one in the seventh year. He could draw the square as well as the diamond, the latter a test of the seventh year. He answered the comprehension questions of the fourth and sixth years correctly. He passed in the 'three commissions' and the 'missing features' tests quite well. He failed, however, in repeating three digits correctly, in counting four pice, in æsthetic comparison, in defining words in terms of use, in distinguishing right and left, in joining the two halves of the divided card, in giving the number of fingers and in the description of pictures.

8. MALIO (MADYA). (C.A. 14 years 6 months. M.A. 4 years. I.Q. 26. Imbecile.)

His father is a watchman. The boy says he has three brothers and a sister but cannot give their names. He can look after himself. He also tends a paralytic and epileptic boy in the Children's Home. He has a sweet disposition and is always pleasant. He does simple woolwork, besides sweeping and washing clothes. He cannot keep his own money. His hand is partially paralysed. Otherwise he keeps good health. He is of the silent type and enjoyed the tests. He passed in all the tests of the third year, in two of the fourth, three of the fifth and one of the sixth year. He passed in the 'comprehension' tests of the fourth and sixth years. He could count four pice, but not thirteen. He could define words in terms of use, do the

three commissions and distinguish between right and left. He could not, however, repeat three digits, discriminate between geometrical forms, draw a square or make æsthetic comparison.

9. SAYYAD. (C.A. 12 years. M.A. 3 years. I.Q. 25. Imbecile.)

The boy can give no information of his parents or other members of his family. He says simply that his father is serving. He cannot make sentences. Physically he is a heavy lumpish boy. He can only dress himself and wash his own eating utensils, but cannot do any other work. With great difficulty he has been entrusted with a needle and thread but can do nothing unless guided stitch by stitch. He always brings other children's work and shows it as his own, probably to get praise. He passed in all the tests of the third year, but could go no further. He compared the two lines with great difficulty. He could not repeat three digits, discriminate between geometrical forms, nor answer simple comprehension questions.

10. MOHENA. (C.A. 10 years. M.A. 2 years 4 months. I.Q. 23. Low imbecile.)

The boy can tell nothing about the members of his family. He tries to say something unintelligible about his mother. He gives his name as Mohena. His speech is not developed. He can only pronounce a few syllables. He can dress himself, feed himself and to a certain extent bathe himself. He tries to join in games of ball and likes the see-saw. He is incapable of any sustained effort. In tests, he could point to parts of his body, and could name two objects in the picture with great difficulty. He could not pass in any of the other tests of the third year, for example, naming familiar objects and comparing two lines.

11. TUKYA. (C.A. 12 years. M.A. 2 years 2 months. I.Q. 18. Idiot.)

His father is a mill hand. Physically he appears to be wiry and strong. He is reported to be syphilitic and epileptic. He does not make complete sentences but repeats each word three times. He always talks about two or three topics—one of these is 'paisa' and another is 'ladder'. He grinds his teeth and makes ugly grimaces. He hugs round the shoulders of any visitor. He yells when restrained, crams food into his mouth until his mouth can hardly hold it. He licks his plate so clean that it is impossible to tell that it has not been washed. He is very destructive—tears his clothes and smashes his eating utensils.

He has to be helped to dress. He has no sense of decency—walks naked in front of anybody. He is very restless at night, often does not sleep, nor lets other people sleep. In tests, he could pass only in one test of the third year—pointing to parts of the body. Of the five familiar objects he could name only the pice and the pencil. His attempts at drawing the square produced only one small circle and two irregular figures.

APPENDIX B

Table: Showing the organization of Day Schools and Residential Institutions or Occupation Centres suggested for the mentally defective and the very backward children in the towns of India with a population of not less than 1,00,000.[1]

Age	I.Q.	Type of School or Institution
6 to 14	Under 40	Occupation centre or residential institution.
6 to 14	40 to 60	Special school for feeble-minded children.
6 to 14	60 to 80	Special school for borderline and very backward children or special class in ordinary primary school.
Above 14	Under 40	Occupation centre or residential institution. (Lower order.)
	40 to 50	Occupation centre or residential institution. (Higher order.)
	50 to 80	Simple vocational school for borderline and very backward adolescents.

NOTE.—The Children's Act of the Government of India does not treat the problem of mental defectives on scientific lines. It speaks only of sane and insane persons and does not recognize that there may be classes among the mentally unsound children as well as adults. Among children there may be ever so many classes as morons (or feeble-minded), imbeciles, and idiots, who require different kinds of treatment. Similarly among the adults there may be cases, who may be congenitally of an unsound mind and may be classed as above, namely, the morons (or feeble-minded), the imbeciles, and the idiots, or there may be persons who may have been normal in their earlier life, but may have become unbalanced owing to some emotional stress or some disease. It is high time that the Indian Government recognized this position, had the whole question investigated scientifically by an expert committee and passed an Indian Mental Deficiency Act on the analogy of the English Mental Deficiency Act. This question is closely connected with the question of criminality and beggary. Some of the crimes and begging may originate from the mental deficiency of the persons involved. Every free government tackles the question as a whole and this stupendous question of the subcontinent of India will be said to be properly solved when every criminal, every beggar and every physical and mental defective, or physically or mentally diseased person is properly treated, properly housed and properly employed, so that criminality and beggary may be said to have materially disappeared from India.

[1] Cf. Table C, p. 168 of the *Report of the Mental Deficiency Committee of England*, Pts. I and II (H. M.'s Stationery Office, 1929).

APPENDIX C

SEX DIFFERENCES AMONG INDIAN CHILDREN IN THE BINET-SIMON TESTS

INTRODUCTION

While standardizing the Binet-Simon Tests for Indian Children from the Stanford version, certain sex differences were noticed and these are given in brief here. It is interesting to note how these tests work in different societies and environments. Although the Indian location of the tests in general agrees remarkably well with that of Binet, Terman, or Burt,[1] certain significant sex differences were noticed, which it is of interest to compare with the observations of others. To begin with it must be remembered that in Indian society the girls grow up in a different environment from that of boys. They spend more of their time in the company of their mothers and other female members of the family, the majority of whom are still illiterate, whereas the boys spend more of their time with their fathers who are more literate. Further, it is still the fashion to bring up girls to be good mothers and housewives and to bring up boys for a literary career. All the boys and girls in this study, however, except those of pre-school ages, were school-going children.

COMPARISON OF THE MENTAL AGES OF BOYS AND GIRLS AT VARIOUS AGES

The average mental ages of boys and girls for the several chronological ages are given in the table on page 242.

[1] See *The British Journal of Educational Psychology*. Vol. IV, Part III, November, 1934, pp. 296-309. For a complete description of the experiment see Ch. IV.

The agreement between the *order* of difficulty of the tests in the four revisions alluded to was calculated by using Spearman's rank-differences formula with squared differences. Only tests which were very nearly alike were taken into consideration. As the Stanford revision was more closely followed than the others the number of tests considered from this revision was the largest. The coefficient of correlation thus calculated between present revision and Binet (1911) was .966 (39 tests); present revision and Terman's Stanford revision .984 (67 tests); and present revision and Burt's London revision .970 (43 tests). It should be remembered, however, that these values are no measure of the agreement of placing of the tests in the different age groups, since it is possible to obtain a perfect correlation of 1, although the placing of tests may vary very

Chronological ages	Boys		Girls	
	Number	Mean mental age	Number	Mean mental age
2 to 2, 11 ...	20	2·7	15	2·6
3 to 3, 11 ...	20	3·58	20	3·46
4 to 4, 11 ...	25	4·49	16	4·47
5 to 5, 11 ...	39	5·57	24	5·04
6 to 6, 11 ...	28	6·38	37	6·22
7 to 7, 11 ...	44	7·39	50	6·72
8 to 8, 11 ...	35	9·16	46	8·16
9 to 9, 11 ...	39	9·79	41	8·94
10 to 10, 11 ...	61	11·3	42	9·67
11 to 11, 11 ...	55	11·55	38	10·65
12 to 12, 11 ...	54	12·67	31	12·58
13 to 13, 11 ...	50	14·0	32	14·06
14 to 14, 11 ...	38	14 53	18	13·73
15 to 15, 11 ...	44	15·86	13	14·83
16 and above ...	86	15·75	13	14·83

It will be seen that the boys and girls start together, but as they grow older the differences between them become wider and wider, the girls throughout progressing at a lower level until about the eleventh year, when their curve again shows a steeper ascent and overtakes that of boys at about the thirteenth year. They again fall back slowly at higher ages.

Baldwin and Stecher[1] tested 143 American children repeatedly, by the Standard Revision of the Binet Test. Comparing the Indian results with one of Baldwin and Stecher's graphs we see that there is a somewhat close resemblance between the two graphs of growth, if some allowance be made for the different environment of Indian girls. In both there is a tendency for the graph of girls' growth to be slightly below that of boys until about the eleventh year. From the eleventh to about the fourteenth the girls' graph rises more steeply and is higher than that

much. Thus keeping the order of the tests the same we may put the tests of the third year in the fourth, those of the fourth in the fifth, and so on, and still obtain a correlation of 1.

[1] B. T. Baldwin, and L. I. Stecher, *Mental Growth Curve of Normal and Superior Children, Iowa Studies in Child Welfare*, Vol. II, No. 1, 1922, pp. 10-11. Compare also F. D. Brooks, *The Psychology of Adolescence* (Harrap), Chap. V.

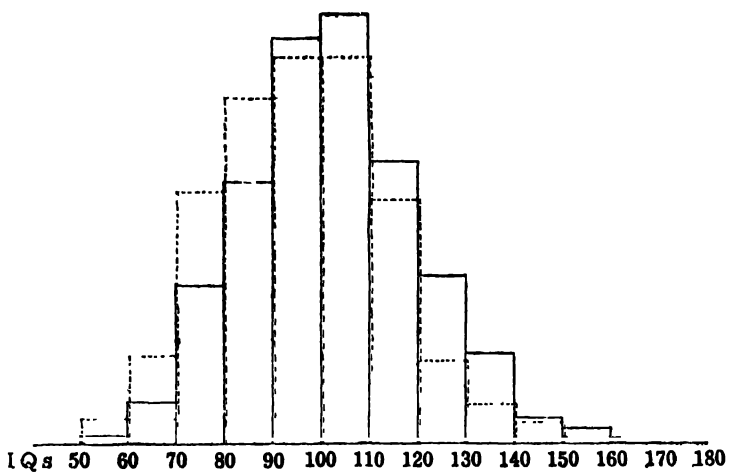
of boys in Baldwin and Stecher's diagram and reaches that of boys in the Indian study. Finally, the girls' graph falls back once more. The steeper rise of the girls' graph between eleven and fourteen may be explained by their earlier adolescence as compared with boys.

Professor Burt in his London Revision found, on the other hand, that the mental ages of girls at almost all ages were slightly higher than those of boys. He says, 'Sheltered, supervised, detained at home, girls, like children of the better classes, incline to sedentary lives and engage in literary pursuits; and, like those children, they consequently excel in linguistic work and conversational activities.'

There is no doubt that environment, social or otherwise, plays a great part in the performances of children in all mental tests. If as Burt says the English girls being sheltered, supervised and detained at home incline more towards literary pursuits, the Indian girls, on the other hand, suffer from a comparative neglect of their literary education.

Comparison of Histograms of Boys' and Girls' I.Q.s.

In the present Indian experiment the number of boys tested was 638 and that of girls 436. The distributions of their I.Q.s. raised to 1,000 in each case for easy comparison are given by the accompanying histogram:



The unbroken line histogram belongs to boys and the broken one to girls.

Looking carefully at the histogram we see that the distribution of girls is shifted slightly towards the left, while the reverse is the case with boys. This may be due to some extent to the superior educational environment of boys as stated above.

The mean I.Q. of all the boys of all ages put together was 102.29, and the corresponding I.Q. of girls was 96.12. The difference of 6.17 is statistically significant, since the standard deviation of the difference equals 1.13 and $\frac{\text{Difference}}{\sigma \text{ Diff}} = 5.46$. The standard deviations of the two distributions were 18.46 in the case of boys and 18.0 in the case of girls. The scatter of the girls' distribution is thus almost the same as that of the boys. The suggestion made by some that girls cluster together more at the centre scarcely holds good in this case.

Comparison of Boys' and Girls' Performances in Individual Tests and in Predominant Abilities

The percentages of boys and girls separately that passed in the various tests of the scale were then calculated. Here it was noticed that in the lowest group of tests, namely, those of year III, the boys had three items to their credit and the girls four, and the differences in the performances of the two sexes were insignificant. As we ascend the scale into the higher age groups the number of items in which girls show superiority quickly diminishes until from the eighth year group onwards the girls disappear altogether, the boys showing a superiority in all the tests. The differences in their performances also become more and more significant. These differences again become smaller from the twelfth year group, and in the fourteenth year group the girls actually show superiority in three of the tests. Further on they begin to fall back again. Thus the effect of earlier adolescence of girls commencing about the eleventh or twelfth year is seen in their performances in individual tests also.

All the tests in the scale were then grouped in a naive manner into eight predominant abilities and the number of items captured by the two sexes in these abilities was noted. The table on page 245 gives the results.

In 'performances', that is, in manipulating ability, the boys and the girls have an equal number of items to their credit.

Kind of Ability	No. of tests in which boys were superior	No. of tests in which girls were superior	No. of significant differences
Language or verbal ability	15	1	3 (in favour of boys)
Arithmetical ability ...	6	0	1 (in favour of boys)
'Performance' ...	3	3	1 (in favour of boys)
Immediate memory ...	11	3	2 (in favour of boys)
Æsthetic and drawing ability	6	4	Nil
Comprehension ...	6	0	Nil
Imagery and association	8	1	Nil
General knowledge ...	15	1	1 (in favour of boys)

The girls are also nearly as good as the boys in æsthetic and drawing ability. They show well also in the immediate memory tests of lower ages. In all other abilities the boys show decided superiority. In arithmetical ability and in comprehension the girls show marked inferiority. It may be noticed that in language or verbal ability, in which the feminine sex is supposed to excel, the boys have shown themselves as decidedly superior, and in performance, where one would have supposed that boys would do much better, the two sexes have shown themselves to be equal. Thus the stories of a 'linguistic sex' or a mechanically-minded sex would seem to be myths. The superiority shown by the sexes in such abilities would seem to depend on the opportunities they get to develop these abilities in their daily routine.

Summary and Conclusions

Absence of agreement in the results of mental measurements of different workers seems to be partly due to the indefiniteness of the unit of mental measurement and the nature of the measurement itself. It is also partly due to the fact that mental abilities are more susceptible to change by environment and effort than physical abilities. Again, it must be remembered that man puts forth far greater labour in order to train the mind than he does to train the body. Thus it is quite possible that this immense labour in mental work may wipe out the small native differences

in endowment. Nor are we agreed on what exactly intelligence is or what is the best method of measuring it. Does the ability of the mind depend upon the brain and the nervous system? If we postulate that it does, the next question is: Does intelligence or mental ability depend entirely on the quality of the nervous system or has it anything to do with the quantity also? If it depends only on the quality then there ought not to be any difference between the sexes, as the quality of the germ-plasm would be the same in either case. If the quantity also has to be taken into account we may expect some difference in the mental abilities of the two sexes. At any rate, our methods of measuring mental abilities depend on measuring the output of work done by the mind in a definite amount of time. In other words, to borrow an idea from mechanical science we measure the *power* of the mind. If this be so may it be that if boys and girls were reared up in exactly identical conditions the mental growth curves of boys and girls would show the same characteristics as their physical growth curves? The slightly higher norms for girls than expected obtained by Burt could then be explained by the fact that girls in England incline towards literary pursuits being 'sheltered, supervised and detained at home'.[1] On the other hand, the slightly lower norms of Indian girls would be due to their comparatively inferior literary environment.

Restricting ourselves to experimental studies it is evident that environment and effort play a great part in determining mental abilities. Studies of sex differences and social differences make this quite clear. Taking all studies on sex differences together it would seem that the mental growth of the two sexes is very nearly on the same level; the slightly superior ability shown by either sex may be due to environmental effects. At any rate, environment and effort play such a great part in mental abilities that even if there be any small native differences they are swamped under the influence of these. The slightly greater positive skewness of the boys' histogram in this Indian study makes it probable that there has been some effect of different environment. There are indications also that the curves of physical growth and mental growth resemble each other in particular in respect of bringing adolescence earlier in the case of girls, and fixing the limit of growth at adulthood in the case of both sexes.

[1] Cyril Burt, *Mental and Scholastic Tests.*

APPENDIX D

HEREDITY AND ENVIRONMENT

Owing to the facts that units in the physical world, such as the inch or the pound, are definite and that we can see and measure more or less accurately physical characteristics, such as height or weight, we are easily convinced that children resemble parents, or that one brother resembles another. But when we try to compare persons in their mental characteristics we are not easily convinced. Since the testing of mental traits started some three or four decades ago, various attempts have been made to find resemblances in mental traits which are due to similar heredity or environment. But, owing to the obvious difficulties of recognizing and measuring accurately mental traits, there have been great differences of opinion among psychologists. There are at present two schools, the hereditarians and the environmentalists. If the I.Q.s of brothers and sisters are close together the hereditarians say this is due to the same heredity, while the environmentalists aver that it is due to the fact that the children were brought up in the same environment. If the mean I.Q. of children in a lower stratum of society is less than the mean I.Q. of children in a higher stratum, the environmentalist says this is undoubtedly the result of different environment and the hereditarian says it may be due to different heredity, since people of lower intelligence are driven by competition to the lower occupations. Heredity and environment are so closely interwoven that it has proved very difficult to separate the effects of each.

In this paper it is proposed to give certain resemblances and differences in (*i*) the I.Q.s of siblings, that is brothers and sisters, and in (*ii*) those of children of parents of different occupational status. The reader is at liberty to form his own opinion about the effects of heredity and environment.

Study of Siblings

In this survey of about 1,000 children there were altogether 125 families to which the siblings belonged. On studying the I.Q.s of the children of each family the following facts were observed:

1. One-fourth of the fraternal pairs differ by less than five

points of I.Q. and three-fourths of the whole number differ by less than 20 points.

2. Although the environment of the younger brothers or sisters is supposed to be better, as they have the advantage of association with their elder brothers or sisters, in appreciably more than half the cases the younger children have lower I.Q.s than their older brothers or sisters.
3. Lastly, there are a few cases where one or two children in a family have much lower I.Q.s than the rest of the children in that family; though these children have been reared in the same environment and very probably with the same care, they have remained at a very low level of intelligence.

The co-efficient of correlation of the sibling I.Q.s, when each pair is entered twice in the correlation table, the higher I.Q. against the lower and the lower against the higher as is usually done, is $0.44 + .034$. Other workers have obtained co-efficients between 0.4 and 0.5. Pearson obtained co-efficients of correlation for various physical traits round about 0.5. Since measurements of physical characteristics are more definite these results are as one would expect them to be.

Social Status and I.Q.s

In order to find the relation between the social status of fathers and the I.Q.s of children, the occupations of fathers were divided into six classes and a contingency table prepared as on page 249.

This co-efficient of correlation is fairly large. Other workers have obtained values between 0.21 and 0.53.[1] This shows that there is some unmistakable positive correlation, though not large, between fathers' occupational status and children's intelligence. The difference between the mean I.Q.s of the highest and the lowest class is 33 points. Other workers have obtained similar results.

The next question is, Does this large difference in the mean I.Q.s of the highest and the lowest classes appear at each age level? The table on p. 250 gives the mean I.Q.s of the same

[1] Walter S. Neff, 'Socio-economic Status and Intelligence', *Psychological Bulletin*, December 1938, p. 730.

Intelligence Quotients

Occupations of fathers	Below 80	81–89	90–99	100–109	110–119	120 and above	Total	Mean I.Q.
I. Professors, collectors, deputy collectors, judges, sub-judges, engineers and assistant engineers. ...	1	3	6	6	9	17	42	114
II. Pleaders, secondary school teachers, middle grade officers, doctors, etc. ...	11	27	58	77	56	51	280	106
III. Primary school teachers, drawing teachers, clerks, etc.	32	37	53	62	43	31	258	100.5
IV. Merchants, landlords, skilled artisans, typists, kulkarnis, etc. ...	27	40	50	42	23	21	203	98
V. Petty traders, farmers, gymnasts, compounders, priests, etc. ...	31	33	31	23	13	10	141	93
VI. Postmen, policemen, barbers, cowherds, menial servants, butchers, etc. ...	40	13	13	4	5	1	76	81
Total ...	142	153	211	214	149	131	1,000	

Co-efficient of contingency = 0.413. Co-efficient of correlation = 0.380 (by diagonal adding).

six classes at different age levels. The table is to be read as follows: the central figure in each cell gives the mean I.Q. and the figure in brackets underneath it the frequency. The figure in the top right-hand corner gives the highest I.Q. and that in the bottom right-hand corner the lowest I.Q. of that cell. The mean I.Q.s from frequencies less than five are italicized and may be neglected. Looking at the rest of the table we see that there is

MEAN I.Q.S BY CHRONOLOGICAL AGES

	2–4 years	4–6 years	6–8 years	8–10 years	10–12 years	12–14 years	14–16 years	Adult	Total No.
I	*108.2* (2)	113 94 3 (5) 73	*108.1* (3)	142 129 4 (5) 109	176 141 2 (10) 117	139 122.6 (5) 97	121 108.1 (7) 94	122 101.5 (5) 83	42
II	136 102 5 (25) 74	14 100 4 (28) 64	137 103.9 (49) 77	149 106.3 (46) 80	152 110.7 (35) 78	156 112 (45) 67	129 106.1 (33) 70	116 99.1 (19) 75	280
III	142 108 8 (19) 91	129 102 1 (27) 73	125 92 5 (30) 72	159 103 1 (38) 72	146 99 (50) 49	133 104.1 (48) 73	136 99.4 (24) 68	126 97.4 (22) 59	258
IV	115 107.1 (6) 87	152 100 6 (16) 74	138 92.5 (28) 62	130 90 1 (18) 62	136 98 4 (44) 52	136 103.5 (30) 67	130 97.7 (31) 77	128 98.5 (30) 73	203
V	*115* (2)	121 91.2 (11) 60	120 91 7 (25) 65	111 90 1 (24) 67	143 93.8 (31) 59	121 94 (22) 67	127 9 (10) 56	116 96.4 (16) 73	141
VI		115 91 4 (7) 60	103 79.6 (9) 69	114 84 8 (16) 63	112 80 2 (19) 52	99 74.5 (11) 66	117 81.1 (7) 59	401 87.9 (7) 70	76
Total	54	94	144	147	189	161	112	99	1,000

not much difference between the mean I.Q.s of upper and lower classes up to about year six, which is the normal school-going age. From this point onwards the differences go on increasing rapidly until about the fourteenth year. In the next two age-groups, that is near adulthood, they again become much less. Within each cell, however, even at the earliest ages in all the social classes the differences in I.Q.s remain wide, although at the higher ages they are wider than at the lower.

Conclusions

Although it is very difficult to make out a clear case either for the hereditarians or the environmentalists, this study seems to point to the fact that heredity is undoubtedly a great factor in determining the innate mental ability of a child. In the first place, although the resemblances in I.Q.s among brothers and sisters do not prove either case, the fact that younger children do not show any improvement over older favours the argument of the hereditarians. Secondly, the case of the hereditarians is strengthened by the fact that even at the lowest ages there are wide differences between the maximum and the minimum I.Q.s of each cell in different social groups, while the mean I.Q.s of the several groups are very nearly the same. On the other hand, from about the sixth year, when children are usually sent to school and when educational effort and social and literary environment play a great part in developing their mental abilities, the differences in the mean I.Q.s of children of different social status go on increasing till about the twelfth year, when they reach the maximum. If we assume that the Binet tests measure the native intelligence with a fair degree of accuracy, these facts indicate that environment also has a fair share in the development of intelligence. Possibly the case is not unlike that of physical development. A person of weak physical heredity can hardly grow to be a giant, but it is possible for him to rise some steps higher in the scale of physical ability by dint of constant practice. Similarly, a child of low I.Q. may gain a few points in a few years by conscious effort and better environment. It seems probable that there is a maximum and a minimum limit between which it is possible to train the *powers* of the body and the mind.

APPENDIX E

GUJARATI STANDARDIZATION OF THE BOMBAY-KARNATAK REVISION OF THE BINET-SIMON SCALE

In the year 1943 Professor (now Principal) Kumari Sulabha Panandikar of the Secondary Training College, Bombay, suggested to Shri N. N. Shukla that he should try the Bombay-Karnatak Revision of the Binet-Simon Scale on Gujarati children in Bombay and bring out a Gujarati standardization. Shri Shukla did this work with great success and completed the work in 1947. His results were presented in the form of a thesis for the M.Ed. degree of the University of Bombay. He followed the Bombay-Karnatak version and procedure very closely and found almost identical results with the Gujarati children, as will be seen from the following table which gives the tests and their locations in the Bombay-Karnatak and the Gujarati Revisions. The roman figures in the table give the age for which the test is found suitable and the figures in brackets beneath them give the percentage of children of that age group which passed the test in the two revisions. The last column shows any serious deviation from the Bombay-Karnatak Revision made in the Gujarati Revision.

Name of Test	Age assignment and percentage in Bombay-Karnatak Revision	Age assignment and percentage in Gujarati Revision	Deviation from the Bombay-Karnatak test made in the Gujarati test
Pointing to parts of body ...	III (100)	III (100)	
Naming familiar objects ...	III (57·1)	III (56·15)	
Repeating 2 digits ...	III (69·2)	III (65·85)	
Enumeration of objects in a picture ...	III (40)	III (36·59)	The pictures have been given a Gujarati outlook, but are very similar

Name of Test	Age assignment and percentage in Bombay–Karnatak Revision	Age assignment and percentage in Gujarati Revision	Deviation from the Bombay-Karnatak test made in the Gujarati test
Repeating 6 to 7 syllables ...	III (35.3)	III (36.59)	
Comparison of lines ...	III (38.7)	III (41.46)	
Repeating 3 digits ...	IV (71.8)	IV (62.22)	
Discrimination of forms ...	IV (64.1)	IV (48.89)	
Comprehension, first degree	IV (64.1)	IV (55.56)	
Repeating 12 to 13 syllables	IV (31)	IV (48.88)	13 to 14 syllables have been substituted for 12 to 13 syllables
Counting 4 pice ...	IV (12.8)	IV (35.56)	
Copying a square ...	IV (5.1)	IV (26.67)	
Æsthetic comparison ...	V (30)	V (49.06)	
Definitions in terms of use ...	V (47.5)	V (50.94)	
Three commissions ...	V (47.5)	V (68.26)	
Distinguishing right and left	V (45)	V (50.94)	
Naming 4 coins ...	V (32.5)	V (64.14)	
Counting 13 pice ...	V (16.5)	V (39.62)	
Repeating 4 digits ...	VI (47.6)	VI (42.68)	
Comprehension, second degree	VI (49.2)	VI (47.56)	
Divided card ...	VI (45.3)	VI (42.68)	
Giving number of fingers ...	VI (46.9)	VI (45.12)	
Description of pictures ...	VI (40.6)	VI (35.36)	As in Enumeration of objects test

Name of Test	Age assignment and percentage in Bombay–Karnatak Revision	Age assignment and percentage in Gujarati Revision	Deviation from the Bombay–Karnatak test made in the Gujarati test
Missing features ...	VI (33.3)	VII (52·69)	The pictures have been given a Gujarati outlook
Repeating 16 to 18 syllables	VII (50)	VI (50)	18 to 20 syllables have been substituted for 16 to 18 syllables
Copying a diamond ...	VII (45)	VIII (61·16)	
Repeating 3 digits reversed	VII (42·4)	VII (34·41)	
Naming days of week ...	VII (40·4)	VII (41·94)	
Counting backwards 20 to 1 ...	VII (35·9)	VII (41·94)	
Giving differences from memory ...	VII (33·3)	VII (31·18)	
Finding value of coins ...	VIII (50.7)	VIII (65·04)	
Repeating 5 digits ...	VIII (41.5)	VIII (56·35)	
Comprehension, third degree	VIII (44·1)	VIII (51·45)	
Definitions, superior to use ...	VIII (41)	VIII (66·01)	
Naming 6 coins ...	VIII (35·1)	VII (51·61)	
Reading and report ... (2 facts, 10 errors, 2 minutes)	VIII (40)	VIII (54·36)	
Repeating 4 digits reversed ...	IX (61·3)	IX (46·78)	
Making change ...	IX (57·5)	IX (69·72)	
Giving similarities, 2 things...	IX (36·8)	IX (42·20)	
Using 3 words in a sentence...	IX (44·3)	IX (27·52)	
Reading and report ... (6 facts, 5 errors, 1 minute)	IX (38·8)	IX (35·77)	
Free association, 35 words in 3 minutes ...	IX (44.8)	IX (54·12)	

Name of Test	Age assignment and percentage in Bombay-Karnatak Revision	Age assignment and percentage in Gujarati Revision	Deviation from the Bombay-Karnatak test made in the Gujarati test
Arranging 5 weights ...	X (49·3)	X (45·53)	
Repeating 20 to 22 syllables ...	X (46·7)	X (55·35)	
Naming the months ...	X (41·4)	X (35·71)	
Drawing designs from memory	X (31·6)	X (50·0)	
Finding rhymes ...	X (26·9)	X (34·46)	
Reading and report ... (8 facts, 2 errors, 40 seconds)	X (36·7)	X (31·25)	
Detecting absurdities ...	XII (39·3)	XII (36·66)	
Construction puzzle ...	XII (38·4)	XII (46.66)	
Defining abstract words ...	XII (39)	XII (31·42)	
Repeating 5 digits reversed ...	XII (42·3)	XII (31·9)	
Interpretation of fables ...	XII (35·1)	XII (29·04)	
Interpretation of pictures ...	XII (29·2)	XII (36·66)	
Induction test, Finding a rule	XIV (63·2)	XIV (33·52)	
Dissected sentences ...	XIV (56·6)	XIV (58·79)	
Arithmetical reasoning ...	XIV (47·6)	XIV (36·81)	
Problems of enclosed boxes	XIV (53)	XIV (48·9)	
Giving similarities, 3 things	XIV (38·4)	XIV (31·32)	
Ball and field, superior plan	XIV (54·5)	XIV (53·30)	
Interpretation of fables ...	XVI (50)	XVI (50·41)	
Reversing hands of clock ...	XVI (51·4)	XVI (57·04)	

Name of Test	Age assignment and percentage in Bombay-Karnatak Revision	Age assignment and percentage in Gujarati Revision	Deviation from the Bombay-Karnatak test made in the Gujarati test
Giving differences—Patil and Kulkarni	XVI (47.2)	XVI (43.75)	An alternative form has been used—Police Commissioner and Municipal Commissioner
Repeating 6 digits reversed ...	XVI (44.9)	XVI (37.04)	
Problem questions ...	XVI (44.6)	XVI (39.26)	
Repeating 7 digits ...	XVI (41.4)	XVI (36.30)	
Using a code ...	XIX (39.8 Adult)	XIX (46.34 Adult)	
Ingenuity test ...	XIX (36.2 Adult)	XIX (28.05 Adult)	
Differences between abstract terms	XIX (41.4 Adult)	XIX (31.7 Adult)	
Binet's paper-cutting test ...	XIX (32.3 Adult)	XIX (37.81 Adult)	
Repeating 30 syllables ...	XIX (30.5 Adult)	XIX (47.56 Adult)	
Reversing triangle in imagination (Bombay-Karnatak form)	XIX (28.1 Adult)	XIX (30.49 Adult)	
Comprehension of physical relations	XXII (9.5 Adult)	XXII (11.51 Adult)	
Repeating 8 digits ...	XXII (7.2 Adult)	XXII (7.31 Adult)	
Repeating thought of passage heard	XXII (13.3 Adult)	XXII (21.95 Adult)	
Reversing triangle in imagination (Binet's form)	XXII (3.3 Adult)	XXII (12.91 Adult)	
Repeating 7 digits reversed ...	XXII (8.2 Adult)	XXII (7.31 Adult)	
Free association, 80 words in 3 minutes	XXII (12.3 Adult)	XXII (24.39 Adult)	

It should be noted that the Gujarati children generally did slightly better in repetition of syllables tests and in the coins tests—naming, counting and calculating. In a few cases the year of location of the test has been changed. In such cases the percentage of passes shown belongs to the year printed above the percentage. For example, the test of copying a diamond was answered by 45 per cent of the children of the *seventh* year in the Bombay-Karnatak Revision and by 61.16 per cent of the children of the *eighth* year in the Gujarati Revision.

The Gujarati Handbook for these tests, by N. N. Shukla, together with the test material, is published by Macmillan & Co., Bombay.

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